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ERGOGRAPHIC STUDIES IN MUSCULAR SORENESS.*

THEODORE HOUGH.

(From the Physiological Laboratory of the Massachusetts Institute of Technology and the Boston Normal School of Gymnastics.)

In my paper on neuro-muscular fatigue published in this journal for May, 1901, I made but slight reference to the subject of muscular soreness beyond the statement that "when an untrained muscle makes a series of contractions against a strong spring, a soreness frequently results which cannot be regarded as a phenomenon of pure fatigue." Further discussion of the matter was postponed to await the completion of the experiments which form the basis of the present paper.

The use of the word "trained" at that time was somewhat indefinite, and it may be well at the outset to define my use of it then and now, in order to prevent possible misconception. By a trained muscle or a muscle in training is meant one which has been making regular ergographic experiments for some time previously without resulting soreness or lameness. The muscle may have been accustomed to ergographic work and may be very strong; but if a considerable period of time have elapsed since the last experiment, such a muscle would be classified as untrained or out of training. I am unable to state what length of time must elapse to put a muscle out of training; but I have never classified a muscle as trained unless it had made an experiment within the preceding three weeks.

My attention was first attracted to the subject of muscular soreness in the latter part of November, 1899. Six months before a series of almost daily ergographic tracings from the flexors of the middle finger had been brought to a conclusion.† The muscle was in a high degree of training, the curve of work always falling asymptotically to a constant fatigue level, from which recovery took place rapidly on passing to a slower rhythm. No soreness had been noticed.

---

* Reprinted by permission from the American Journal of Physiology, Vol. VII, No. 1., April 1, 1902.

† Hough: American Journal of Physiology, 1901, v, pp. 258-259. The ergographic methods used in the present series of experiments are the same as those given in the above paper. The formula $\frac{C}{R} = \frac{\text{M Sec.}}{\text{N Sec.}}$ refers to the rhythm and means that it consisted of alternate periods of M seconds of contraction and of N seconds of rest.

The experiments were resumed in November, after the lapse of six months, during which no ergographic tracings were taken nor any work done which involved hard work on the part of the muscles in question. The first tracing (November 30) was recorded without discomfort at the time of experiment, but it was noticed that it failed to show a fatigue level. This is shown in Fig. 1, which will enable the reader to compare the result of this experiment with that of one taken during the previous period of tracing. It was also observed that, not only did the curve in the former case continue to fall to the end of the experiment, but that the fall was not uniform; on the contrary, sudden diminutions were frequently noticed in the height of the contractions, as shown somewhat imperfectly in the figure. The same thing has been more or less marked in the nine other initial tracings taken from the untrained muscle during the past two years.

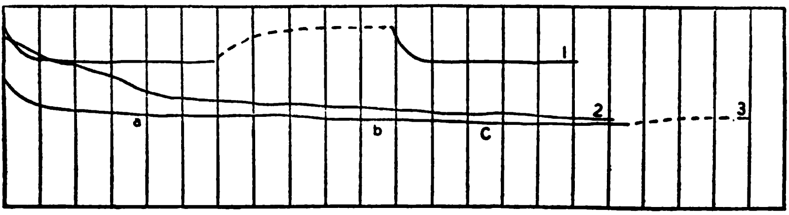

Figure 1.—1. Curve plotted from a tracing given by the trained muscle, May 5, 1899. 2. Curve plotted from the initial tracing of the same muscle out of training, Nov. 30, 1899. 3. Curve plotted from the tracing of the same muscle on the following day (Dec. 1, 1899) while in a condition of soreness. In this curve, the contractions were very painful at *a;* much less so at *b;* at *c* the pain had entirely disappeared, or was noticed only at the height of contraction and then was slight,

$$\text{———} = \text{Rhythm, } \frac{C}{R} = \frac{\frac{1}{2}\text{ sec.}}{\frac{3}{2}\text{ sec.}} \qquad \text{- - - - -} = \text{Rhythm, } \frac{C}{R} = \frac{\frac{1}{2}\text{ sec.}}{\frac{19}{2}\text{ sec.}}$$

Abscissæ give time in minutes.

As already stated, no discomfort accompanied this tracing, nor was any noticed for some hours afterward. Eight or ten hours later, however, the muscle began to show signs of soreness, and this soreness increased to its height twelve or more hours after the tracing. In other subjects this soreness has appeared much later, reaching its maximum as late as forty-eight or even sixty hours after the tracing.

On the following day, while the muscle was still sore, a second experiment was made. For the first two or three minutes the act of contraction against the resistance of the spring was excessively painful, as if countless needles were being driven into the arm. This pain, however, gradually wore away as the experiment continued, and in the course of five or ten minutes had entirely disappeared, or was noticed only at the height of contraction.

The curves obtained on the first and second days may be compared by reference to Fig. 1. It will be noticed that the disappearance of pain was without effect on the height of contraction, which, under the conditions of our experiments, is equivalent to saying that it was not accompanied by improvement in the strength of the muscle. It will also be noticed that the rather striking level of work maintained throughout the second experiment is approximately that to which the curve of the previous day had fallen.

The soreness, which thus disappeared during the tracing and which was not noticed for some hours afterward, returned in ten or twelve hours and ran the same general course as that observed after the tracing of the first day. On the following (third) day a similar experiment gave a curve almost identical with that of the second day. Indeed, no improvement whatever was noticed in the working capacity of the muscle so long as daily experiments were made; each tracing gave the same reduced level of work; the soreness, at first very intense, passed off in from five to ten minutes, to return some hours later. Such daily experiments were made for six days.

I have previously shown that on changing from the rhythm $\frac{C}{R} = \frac{\frac{1}{2}\text{ sec.}}{\frac{3}{2}\text{ sec.}}$ to the rhythm $\frac{C}{R} = \frac{\frac{1}{2}\text{ sec.}}{\frac{19}{2}\text{ sec.}}$ practically complete recovery occurs in the trained muscle within some ten minutes. It is interesting [illegible] note that neither in the first nor in subsequent tracings of this and similar series was any marked recovery observed in the sore muscle. A somewhat greater recovery may be obtained by massaging the muscle between contractions, but even this improvement is comparatively insignificant.

Finally the soreness gradually passed away when periods of from four to seven days were allowed between tracings. In the course of a month and a half the working capacity of the muscle, as indicated by the height of the initial contraction and of the fatigue level improved step by step until it was somewhat better than that observed eight months before. The third series of experiments given in my former paper* were from this period, after the muscle was again in training.

---

* Hough: American Journal of Physiology, 1901, v, p. 260.

The experiments of this series were made with the rhythm $\frac{C}{R} = \frac{\frac{1}{2}\text{ sec.}}{\frac{3}{2}\text{ sec.}}$ Later, when soreness no longer accompanied or followed work, an experiment was made with sustained volitional tetanus which brought out a new phase of the matter. I have elsewhere commented on the frequently painful character of these tracings, and this one was no exception. Five contractions of from four to two minutes' duration were made, with intermissions of two minutes' rest. The pain may be described as beginning with a dull ache which increased in intensity until it was almost unbearable. It began in the first tetanus during the third minute, in later tracings after the first thirty seconds, becoming more intense with each succeeding tracing. Immediately after the close of the experiment no marked discomfort was noticed; within fifteen minutes, however, the flexor muscle* felt lame, was sore to the touch, and contraction against even slight resistance was uncomfortable or even painful. Although I have no record of the exact time at which this condition was most marked, it is safe to place it about one half hour after the end of the experiment. From this time it gradually wore off, disappearing entirely within four hours. It will be remembered that, in the experiments described at the beginning of this paper, no discomfort whatever was experienced during the experiment nor for several hours afterward. On the following day the usual rhythmic tracing was taken to test the working capacity of the muscle, which was found to be in a perfectly normal condition, showing no diminution in the height of the initial contraction or of the fatigue level, and suffering no soreness either during or after the experiment.

These two experiences, thus described in some detail because subsequent experience has shown me that they are quite typical, suggested the advisability of studying the whole phenomenon of muscular soreness (resulting from work) on a large number of individuals. Observations have accordingly been made, under my direction, by members of the senior class of the Boston Normal School of Gymnastics, partly in the physiological laboratory of the Massachusetts Institute of Technology, but mostly at the Normal School of Gymnastics. The subjects of experiment were in all cases students or instructors of the latter school. Speaking for those who have worked with me in the study of this problem it gives me pleasure to thank those who have served as subjects of experiment and for myself to acknowledge my own indebtedness to those who have so carefully and efficiently conducted the observations.

---

* It will be understood that the pain, soreness, lameness, stiffness, etc., mentioned in this paper always refer to the condition of the belly of the muscle, and in no case to the carpal portion of its tendon or to the fingers.

During the spring of 1900 experiments were conducted by Miss Mabel D. Cherry, Miss Susanne A. Craig, Miss Marian D. Richards, and Miss Gertrude L. Farmer. A preliminary account of their results* has already appeared. In order to increase the number of observations and to settle, if possible, certain questions suggested by their results, a second and more extensive series of observations was undertaken in the spring of 1901 by Miss Harriet Wilde, Miss Grace L. Shepardson, and Miss Lilian Gleason.

The results of these two series of observations are given in Table I. Except in the case of one subject (T. H.), the adjustable hook of the finger splint was attached at approximately 1⅛ inches (28 mm.) from the joint. Owing, however, to the inexperience of some subjects in adjusting the splint, it should be said that it is not safe to assume that this distance was always accurately determined; in a few cases the adjustment was not made at all. This error is, however, of little importance in the present investigation, since our study does not involve comparison of daily records from the same individual; it is mentioned here, because the experiments have been arranged in the table in the order of the height of contractions. While this no doubt gives approximately the relative strength of the same muscle in different subjects, the classification is not absolutely accurate.

Study of the results will, I think, bear out the following conclusions:

1. There are two kinds of muscular soreness or lameness. The first is very marked during work and may be noticeable for three or four hours afterward; it then passes away entirely. The second kind, on the contrary, is not noticed at all at the time of the tracing nor for some time afterwards; it usually begins about eight hours after the work, increases to a maximum which may occur from ten to twenty-four, or even more hours later; indeed this soreness may not make its appearance until the second day after the tracing; it gradually passes away, but may be noticeable for four or more days when the muscle is contracted against resistance or is over-extended.

---

*Hough: Journal of the Boston Society of Medical Sciences, 1900, v, pp. 81-92.

TABLE I.

Sustained volitional tetanus							
					Soreness		
Subject	Date	Observer	Height of initial contraction cm.	Height at 3 min. cm.	During work	1-3 hours after work	12 hours after work
A. L. R.	1890. ——	M. D. C.	8.5	2.4	Yes	No	No
F. Y.	——	“	8.3	5.6	Yes!	No	Very slight
B. W. H.	——	“	6.9	2.8	No	No	No
M. G. C.	——	“	6.9	1.9	Slight	No	No
G. E. F.	——	“	6.6	1.7	Yes!	Yes	Yes
M. F. S.	——	“	6.0	2.6	?	?	Yes
M. B.	——	“	5.6	2.1	Yes	No	No
B. B. W.	——	“	5.5	1.7	Yes	No	No
A. L. D.	——	“	5.4	1.4	No	No	Yes
A. F. H.	——	“	5.0	1.6	?	No	No
J. A. B.	——	“	5.0	1.3	No	No	No
J. T.	——	“	4.5	0.8	Yes	Yes	Yes
M. D. C.	——	“	4.2	1.4	No	No	No
M. P.	——	“	3.5	1.4	Slight	No	No
T. H.	1901. Mar. 15	H. W.	8.5	2.9	Yes!	Yes	Yes
G. L. S.	“ 22	“	5.7	——	No	No	No
“	“ 29	“	5.6	1.4	Yes	No	No
C. A. B.	Apr. 11	“	5.4	1.3	Yes	No	No?
M. M. T.	“ 23	“	5.3	2.2	Yes	No	Yes
M. J. S.	“ 10	“	4.7	2.0	Yes	Slight	No
F. C.	Mar. 25	“	4.6	——	Yes	Yes	No
H. W.	“ 29	“	4.6	1.5	Yes	No	No
S. L. S.	“ 25	“	4.2	——	Yes	Slight	No
E. M. S.	“ 28	“	4.1	1.2	No	No	No

TABLE I (*continued*).

Subject	Date	Observer	Height of initial contraction	Height at 3 min. cm.	Soreness		
					During work	1-3 hours after work	12 hours after work
H. W.	1901. Apr. 1	H. W.	3.9	1.4	Yes	No	No
"	Mar. 22	"	3.9	1.2	Yes	No	No
E. P.	Apr. 8	"	3.8	0.8	Yes!	Yes	Yes

Rhythm $\frac{C}{R} = \frac{1 \text{ sec.}}{1 \text{ sec.}}$

Subject	Date	Observer	Height of initial contraction	Height of fatigue level	Soreness		
					During work	1-3 hours after work	12 hours after work
M. F. S.	1900. ——	S. A. C.	7.8	5.5	No	No	Yes
H. M.M.	——	"	7.5	4.3	Yes	No	No
J. I. G.	——	"	5.5	3.5	No	No	Yes!
M. Bd.	——	"	5.5	2.5	No	No	No
A. L. D.	——	"	4.8	2.8	No	Slight	No
S. A. C.	——	"	4.5	1.8	No	No	No
C. N. R.	——	"	4.0	2.5	No	Slight	Yes!
M. H. H.	——	"	3.0	2.0	No	No	No
T. H.	1901. Apr. 26	C. L. G.	6.2	3.0	No	No	Yes
C. S. M.	" 17	"	8.4	5.1	No	No	Yes
A. L. R.	" 17	"	5.7	3.7	No	No	Slight
G. G. W.	Mar. 27	"	5.4	2.8	No	No	Yes
G. L. S.	" 25	"	5.2	2.7	No	No	No
E. L. S.	Apr. 13	"	4.7	3.0	No	No	No
G. L. S.	May 8	"	4.5	2.1	Yes	No	Slight
H. S. M.	Mar. 27	"	4.4	2.8	No	?	?

TABLE I (*continued*).

Subject	Date	Observer	Height of initial contraction	Height of fatigue level	Soreness		
					During work	1-3 hours after work	12 hours after work
B. P. E.	1901. Apr. 9	C. L. G.	4.4	2.3	No	No	No
M. Bd.	" 9	"	4.1	2.2	No	No	Very slight
C. A. B.	" 30	"	3.8	2.1	No	No	Slight
A. W. P.	Mar. 28	"	3.4	2.3	No	No	No
O. P.	Apr. 9	"	3.4	1.5	No	No	No
M. M. F.	" 17	"	2.4	1.8	No	No	No
Rhythm $\frac{C}{R}=\frac{1 \text{ sec.}}{9 \text{ sec.}}$							
A. L. R.	1900. ——	G. L. F.	9.3	8.0	No	No	Yes
F. Y.	——	"	8.0	6.6	No	No	Yes
A. B.	——	"	7.9	6.9	No	No	Yes
C. S. M.	——	"	6.9	6.8	No	No	Yes
G. L. F.	——	"	....	....	No	No	Yes
A. O. B.	——	"	5.6	3.0	Yes	No	Slight
M. G.	——	"	5.5	5.0	No	No	No
A. C. H.	——	"	4.5	3.5	Slight	Yes	Slight
E. M. M.	——	"	4.5	3.2	No	No	No
E. B. S.	——	"	4.3	2.9	No	No	No
M. H. H.	——	"	3.2	2.4	Yes	Yes	Yes
M. K. K.	1901. Apr. 26	C. L. G.	....	....	No	No	Slight
C. L. G.	" 30	"	....	....	No	No	Yes!
L. N.	" 26	"	....	....	No	No	No

TABLE I (*continued*).

Rhythm $\frac{C}{R}=\frac{\frac{1}{4}\text{ sec.}}{\frac{3}{4}\text{ sec.}}$

Subject	Date	Observer	Height of initial contraction	Height of fatigue level	Soreness		
					During work	1-3 hours after work	12 hours after work
T. H.	1900. ——	T. H.	..	..	No	No	Yes
M. D. R.	——	M. D. R.	5.3	2.0	No	No	Yes
M. D. R.	——	"	4.7	2.9	No	No	Yes
E. B. S.	——	"	4.4	1.7	No	?	Yes
M. D. C.	——	"	4.4	1.4	No	No	Yes
N. G. D.	——	"	4.3	2.4	No	No	No
C. N. R.	——	"	3.8	1.9	No	No	Slight
T. H.	1901. Apr. 15	G. L. S.	6.4	4.1	No	No	Yes
A. L. R.	May 8	"	8.5	5.4	No	No	Yes
C. S. M.	Apr. 15	"	8.0	6.1	No	No	Yes
B. W. H.	Mar. 29	"	6.0	4.3	No	No	Yes
G. L. S.	" 15	"	6.0	2.3	No	No	Yes
E. L. S.	Apr. 8	"	5.8	4.5	No	No	Slight
C. L. G.	May 6	"	5 6	3.5	No	No	No
H. W.	Mar. 29	"	5.5	3.4	No	No	Slight
E. L. S.	" 22	"	5.3	3.4	No	No	Yes!
S. L. S.	Apr. 8	"	5.3	3.0	No	No	Yes
H. W.	Mar. 25	"	5.2	3.5	No	No	No
G. L. S.	" 25	"	5.0	2.5	No	No	Yes
C. L. W.	" 28	"	4.9.	3.1	No	No	Very slight
G. L. S.	Apr. 18	"	4.6	2.3	No	No	Yes
C. A. B.	" 22	"	4.5	2.6	No	No	Yes
G. L. S.	May 6	"	4.4	2.3	No	No	Slight

TABLE I (*concluded*).

Subject	Date	Observer	Height of initial contraction	Height of fatigue level	Soreness		
					During work	1-3 hours after work	12 hours after work
A. W. P.	1901. Mar. 29	G. L. S.	4.3	2.9	No	No	Slight
B. P. E.	Apr. 11	"	3.0	2.4	No	No	No
E. P.	" 22	"	3.0	2.0	No	No	Yes
H. D.	" 11	"	2.1	1.5	No	No	Yes

2. The first kind of soreness is especially characteristic of sustained tetanic contractions and rarely occurs with the rhythmic contractions used in these experiments.

3. The second kind of soreness is comparatively rare after tetanic contractions, but very frequently occurs after rhythmic contractions.

4. It is especially noteworthy that, while the first kind of soreness is most marked where fatigue is greatest (sustained tetanus), the second kind not only follows the less fatiguing work of the usual rhythmic ergographic experiments, but may appear in very intense form after experiments with the slow rhythm $\left(\frac{C}{R} = \frac{1 \text{ sec.}}{9 \text{ sec.}}\right)$ which show relatively slight diminution in the height of contraction, as the experiment proceeds. To this point we shall return; for the present it is desired to emphasize the fact that the intensity of the second kind of soreness not only does not vary with the intensity of fatigue, but seems, on the contrary, to be an entirely independent phenomenon.

5. Both kinds of soreness are, in general, much more marked with those muscles which give the strongest (highest) contractions.

6. While the second kind of soreness followed experiments of the rhythm $\frac{C}{R} = \frac{\frac{1}{2} \text{ sec.}}{\frac{3}{2} \text{ sec.}}$ in 85 per cent. of the cases, it followed those of the rhythm $\frac{C}{R} = \frac{1 \text{ sec.}}{1 \text{ sec.}}$ in only 45 per cent.

In certain subjects of experiment the same muscle was used at different times with different forms of contraction. Table II gives the results in these cases for convenience of comparison, and will be found to support the above conclusions in a very striking manner. Each "yes," "no," or "slight" indicates a separate experiment. The subjects are arranged in general in the order of the strength of pull exerted.

TABLE II.

Showing the occurrence of soreness after ten or more hours in those muscles which worked with more than one rhythm. Where marked soreness followed all kinds of contraction the results are given in italics.

Subject	Tetanus	1 sec. / 1 sec.	1 sec. / 9 sec.	¼ sec. / ¾ sec.
T. H.	*Yes*	*Yes*	*Yes*	*Yes*
C. S. M.	....	*Yes*	*Yes*	*Yes*
F. Y.	Very slight	....	Yes	
A. T. R.	No	Slight	Yes	Yes
B. W. H.	No	....	....	Yes
G. L. F.	*Yes*	....	*Yes*	
M. F. S.	Yes	Slight	....	
G. L. G.	....	No	Yes!	No
A. L. D.	Yes	Slight		
G. L. S.	No, No	No, Slight	....	Yes, Yes, Yes, Yes
E. L. S.	....	No	....	Slight, Yes!
H. W.	No, No, No	....	....	Slight?
C. A. B.	....	Slight	....	Yes
C. N. R.	....	Yes	....	Slight
S. L. S.	No	....	....	Yes
A. W. P.	....	No	....	Slight
E. P.	*Yes*	*Yes*	....	*Yes*
B. P. E.	....	No	No	
M. H. H.	....	No	Yes	

DISCUSSION OF RESULTS. THE NATURE OF THE TWO KINDS OF SORENESS.

The above results are worthy of attention because of the light which they throw on the nature of muscular soreness, and from their bearing upon the technique of ergographic work in general. It will be convenient to discuss these two phases of the matter separately.

The muscular soreness which for the want of a better term we have simply called "the first kind" and which so frequently appears during sustained tetanus would seem to be closely associated with the phenomena of fatigue. Upon this basis it presents little difficulty of explanation. We know that waste products accumulate, first within the sarcolemma and subsequently in the interstitial lymph spaces of the muscle. Loeb* has shown, moreover, that when an excised muscle has been thrown into activity the osmotic tension within the muscle fiber increases, as is shown by its increase in weight when placed in a solution of sodium chloride isotonic with the contents of a resting muscle. It would seem, in view of these facts, that until the blood and lymph currents are able to remove the diffusible wastes from the muscle, there must be more or less œdema in the organ. Whether the pressure of the swollen muscle fibers upon the sensory nerve endings is to be regarded as the cause of the soreness, or whether we are dealing with chemical stimulation of these nerve endings, or whether both causes take part in the soreness, must for the present be left undecided; if the former is the only cause, the thickness of the muscle fiber must obviously be greater than it is in a maximal contraction, where no such soreness is felt.

In the experiments made in 1901, measurements were made of the girth of the forearm before and after the experiment. Four marks were made on the skin over the belly of the flexor muscle so as to get the measurements at the same places. The results on the whole have been unsatisfactory; it is, however, of interest to note that whereas the measurements following rhythmic contractions showed at times an increase, and at other times no change at all, sustained tetanus was always followed by an increase of girth, varying from 3 to 6 mm. On the other hand, equally large increases were sometimes observed after rhythmical work and when no soreness whatever was present.

If this soreness, then, be caused by the same conditions which produce fatigue, namely the presence of the diffusible waste products of activity, we should expect to find, as we do find, that it takes the course described above, passing away within very few hours of the work itself. One other peculiarity of this soreness may also be urged in support of our explanation of its cause. It will be remembered that it was a common experience to find that the pain accompanying the work of sustained tetanus ceased altogether with the end of contraction, while lameness developed to a marked degree during the following half hour or more. This would mean that the pain felt during contraction is partly due to the pressure of the contracted and now somewhat swollen muscle fibers on sensory nerve endings; the release of this element of pressure by the cessation of contraction brings temporary relief; the greatly increased blood-flow, however, which follows the relaxation of the muscle now gives for a time the osmotic conditions favorable for the absorption of water by the fibers, with the return of pressure on their nerve endings. This alone may be enough to produce soreness, which is greatly increased, of course, should the muscle be contracted while in this condition.

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*Loeb: Archiv für die gesammte Physiologie, 1894, lvi, p. 270.

In any case, we should expect the lameness to pass away, as it actually does, with the removal of the diffusible waste products by the blood current. Attention may also be called to the fact that we should expect the soreness to be greatest in the stronger muscles.

Passing now to the second kind of soreness, I think that the facts already given show clearly that it is not a phenomenon of fatigue. It occurs least frequently where fatigue is greatest, that is to say, in sustained tetanus; it rarely follows rhythmic contractions which show marked fatigue, that is to say in those tracings in which the fall to the fatigue level was rapid and the fatigue level itself was low; it has appeared in a most severe form with slow rhythms where the fall in the height of contraction was least of all; and it makes its appearance at a time when we should expect the conditions of fatigue to be entirely removed. The two processes, in other words, run an entirely independent course.

On the other hand, it may appear after any kind of muscular work, especially if the height of contraction be very great, thus subjecting the muscle to great tension.* It follows some kinds of work, however, more readily than others. It almost always appears to a greater or less degree after experiments with the rhythm $\frac{C}{R} = \frac{\frac{1}{2}\text{ sec.}}{\frac{3}{2}\text{ sec.}}$; in a smaller but still large per cent. after experiments with the rhythm $\frac{C}{R} = \frac{1\text{ sec.}}{9\text{ sec.}}$; in a much smaller percentage after experiments with the rhythm $\frac{C}{R} = \frac{1\text{ sec.}}{1\text{ sec.}}$; and least frequently after sustained tetanus.

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* This statement, of course, refers to the height of contraction in our ergographic experiments, which involves correspondingly increased tension.

It varies directly with a combination of two factors; the suddenness and the height of the contraction. The relation between the height of contraction and the frequency of soreness has already been pointed out. As to the suddenness of contraction, it will be seen that soreness is more frequent with the rhythm ½ sec. : $\frac{3}{2}$ sec. than with the rhythm 1 sec. : 1 sec., where the number of contractions in a unit of time is the same but where more time is allowed for shortening. Any one who has used these two rhythms is acquainted with the entirely different psychical effect they produce; in the former the subject feels somewhat hurried, in the latter that there is ample time; the result is that with the former rhythm the contraction inevitably assumes the form of a jerk,—with the latter it is slower and more deliberate.

It will be at once suggested that the results with the slow rhythm $\frac{C}{R} = \frac{1\text{ sec.}}{9\text{ sec.}}$ do not bear out this view of the case. Experience, however, will show that this is not the case. The subject seems to be unconsciously afraid that when the tenth second comes he will not make the best of his opportunity, and he accordingly puts so much effort into the contraction that he gives it in almost all cases the form of a jerk. I am sure, from watching the experiment in some cases where the resulting soreness was very marked, that this is true; moreover, in one experiment which I have myself made with this rhythm upon an untrained muscle and in which special care was taken to avoid the jerk form of contraction, the resulting soreness was comparatively slight. It must also be remembered that this rhythm adds the other factor which we have seen to be so closely associated with the production of soreness, namely the higher contraction, or greater tension.

It seems that not only are these facts all explained on the assumption that the second kind of soreness described in this paper has its origin in some sort of rupture within the muscle itself, but that this assumption explains other things which have been observed. It will be remembered that the initial experiment with an untrained muscle showed a continuous fall in the height of contraction, but that this fall presented frequent sudden diminutions in the height of contraction, from which there was little or no subsequent recovery on passing to a slower rhythm. This is in striking contrast to the result with trained muscles; their curves are strikingly regular under favorable conditions and on passing to the slower rhythm the contractions reach the height of the initial contraction in some ten minutes; indeed, they almost reach this level in two minutes. If now in the untrained muscle, owing to the rupture either of the muscle fibers themselves, or of the connective tissue which transmits the pull of the fiber to the tendon, certain fibers are thrown out of play, the working cross section of the muscle will be to that extent diminished; the height of the later contractions against a spring will be determined not only by the conditions of fatigue but by the diminished number of effective fibers; as these ruptures take place there will be sudden falls in the height of contraction; the slight recovery noticed upon passing to the slower rhythm is due to the amelioration of fatigue conditions, but complete recovery is impossible. This view of the case is further borne out by the facts that the height of the initial contraction on the following day is much lower than in the first experiment of the series, and that the fatigue level is no higher, indeed is practically the same as the final contractions of the first experiment. (See Fig. 1.)

The history of the soreness itself, its appearance only some hours after the tracing, the very painful character of maximal contractions while the muscle is in this condition, the disappearance of the soreness upon continuing these contractions, and its subsequent reappearance some hours later, all present the familiar picture of the formation of adhesions in the process of repair and the painful breaking up of the same adhesions by movement of the affected part. Similarly, the recovery observed when rest is given point in the same direction, and suggest analogous experiences with a sprained joint. It gives me pleasure to acknowledge my indebtedness to Dr. P. M. Dawson, of Johns Hopkins University, for useful suggestions in this connection.

Special attention may also be directed to the fact that the first few contractions of the muscle which is "out of training" show but little diminution in working capacity as compared with that of the same muscle in training. (See Fig. 1.) The fibers of the untrained muscle are not weaker, so far as our evidence goes, than those of the trained muscle.

Why the muscle not in training should act as it does, suffering rupture of its structure, if our explanation be correct, is not clear.

It may be suggested, however, that the efficiency of the muscle as a working machine depends, not only on its cross section and on the strength of the individual fibers, but also on the perfection in the coordination of their work; they must work together to exert the greatest pull. This, in turn, depends on the coordination of their innervation, and suggests that the rupture is due to the uneven action of the stimulating neurones; if, for example, the group of fibers innervated by one motor nerve fiber receive their maximal stimulation while the neighboring fibers, innervated by a second neuron, fail of stimulation or receive a decidedly weaker stimulus, it is probable that the strong contraction of the former group would rupture their connective tissue attachment to the second group and thus initiate the phenomenon of soreness. A muscle out of training would thus differ from one in training not in the condition of the muscle itself but in that of its innervating mechanism. Many facts which I have noticed, and some of which I have already given, might be urged in support of this view; but to discuss the matter at length would lead us too far into regions of speculation for the pages of this journal.

The bearing of these results upon the technique of ergographic work is obvious. The first kind of soreness (that which accompanies or immediately follows work) is a disturbing factor where the ergograph is used for the study of fatigue only in so far as it interferes with the continuance of maximal volitional innervation. The second kind, which we have explained as involving actual rupture within the muscle, is much more serious. Even if we trace it to the fatigue of nerve cells, the tracing gives no intelligible record of such fatigue. A more important matter is the fact that the diminution in the working capacity of the muscle is due not to fatigue alone but to other causes as well; the tracing becomes a record, partly of fatigue, partly of the results of muscular lesions; or, without insisting upon our explanation of the cause of the soreness, the experiments given above leave no doubt that it must be sharply distinguished from fatigue. No ergographic experiment, therefore, which is followed by the least soreness (of the second kind) is trustworthy in the study of simple neuro-muscular fatigue. Such experiments must be made on trained muscles, that is to say, upon muscles which can be depended upon to give typical fatigue curves with the establishment of a fatigue level; and in testing the influence of any agent such as temperature changes, barometric pressure, humidity, smoking, stimulants, special food-stuffs, etc., upon simple neuro-muscular fatigue those experiments which are complicated by soreness should be rigorously excluded. Not only this, but the muscle should in all cases be tested for soreness in the period beginning twelve hours after the completion of the experiment. This is all the more important in view of the fact that the abnormal condition of the muscle frequently escapes notice, unless attention is specially directed to it by making it work or by over-extension.

SUMMARY OF RESULTS AND CONCLUSIONS.

In addition to the results already given on pages 5 and 10, we may add:

1. The first kind of soreness would seem to be due to the same causes as those which produce fatigue, namely the presence of the diffusible waste products of activity.
2. There are reasons for thinking that the second kind of soreness is fundamentally the result of ruptures within the muscle.
3. When the ergograph is used to study fatigue, all experiments which are followed by soreness of the second kind should be excluded; and in all such work the muscle should be tested twelve or more hours later for soreness by contracting it against resistance and by over-extension.

A CONTINUED STUDY OF PUPILS' ATTITUDES.*

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In a previous report upon pupils' attitudes, published in the American Physical Education Review for March, 1901, single observations made upon about fifteen hundred (1484) different pupils in Boston, Waltham, and Bridgewater were tabulated. In this paper the results have been obtained by noting the positions of the same group of pupils four times each day for one week. As a guide for the work, blanks bearing the following points were distributed to class teachers:

I. Good position.
II. Front position (trunk erect).
  1. Knees in desk (both, L. or R.).
  2. Sitting on foot (both, L. or R.).
  3. Leaning on elbow (both, L. or R.).
    Chest flat.
III. Forward position.
    Shoulders rounded.
IV. Bending position.
    Uneven shoulders.†
V. Twisted position.
  1. Entire trunk twisted.
  2. Pelvis front, shoulders twisted.
VI. Sliding down position.
  1. Shoulders front.
  2. Shoulders twisted.

N. B.—If the points 1, 2, 3, under front position or uneven shoulders† appear in any other position, please indicate.

Information as to the following points was also solicited: The grade of the class, the character of the seats, the position of the windows and blackboards; and with each observation the nature and length of the recitation, the kind of day, and the temperature of the room were to be recorded.

The reports selected as the basis for this outline cover the various school grades as follows: Three for each of the first seven grades and two for each of the eighth and ninth, giving a total of about three hundred pupils (312). Only children of average ability have been chosen for study, the number of boys and girls being approximately equal. The observations have been made by grade teachers, or by pupil teachers who were interested in hygiene and physical training.

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* Report of the Public School Section of the Boston Physical Education Society, December 11, 1901.

Before presenting the results of the year's work, it was deemed advisable to find out what had been written upon specific attitudes of school children. Through the courtesy of Clark University, I was given access to their library dealing with child study. There it became evident that very little had been done in this line, except in connection with seating, penmanship, or myopia. An article in the Child Study Monthly deals with "Habitual Postures of School Children"; Noble Smith, M.D., treats of "Posture in School as Influencing Development"; Dr. Eliza M. Mosher deals with "Habitual Postures of School Children"; a translation of Dr. Muller's book treats of "School-Life as a Factor in Spinal Curvature and Awkward Development"; and Rowe, in the "Physical Nature of the Child" has a chapter upon "Habits of Posture". These are the best articles in English upon the subject, but the treatment in each case is general rather than observational. Hence the Section's work seems to be original in this respect—namely, the noting of individual positions.

The pupils studied this year are not the same as last, hence a comparison of results may be interesting. Each year more girls than boys have had the habit of sitting upon one or both feet. Likewise, more boys than girls have been found to slide down in their seats. Hence the question still stands: Why are these attitudes so characteristic of the sexes? Last year, twisted positions seemed more common in grammar than in primary grades. The study of individual children shows that the twisting exists in all grades. But a point strongly emphasized this year is that the twisting is largely dependent upon the work being done. In one grade, in the study of a chart, each of the eight pupils was twisted to the left. In the next observation, arithmetic, four of the eight were still twisted to the left, while one was bent in the same direction. Again, as the teacher talked from one side of the room, the entire group was twisted to the left. The previous report indicated that between the fourth and seventh grades (ages 8-13), there was an increase in faulty positions. The study of individual pupils shows the maximum of forward positions, bends, and twists to occur at this time. Why are these attitudes, so harmful to symmetry and health, accentuated in this growing period?

It is well known that fatigue resulting from activity of mind or body may be modified by environment. Thus, damp, muggy days, by hindering the elimination of waste material, are conducive to fatigue. Foster* is quoted as saying that the loss of physical power on such days can be measured in foot-pounds. Teachers generally believe posture to be more faulty at such times. In this connection, this comparison selected from observations made upon the same pupils in the same subject at the same time, except on different days, is interesting:

Reading. 3.40 P. M. Thirty minutes.

	Dull, muggy. 72°.	Pleasant. 78°.
Boy.	Forward position, feet crossed.	Good position.
"	Bent left. Shoulders uneven.	Sliding down.
"	Front. L. foot in desk iron.	Good position.
"	Good position.	Front. Feet crossed.
"	Forward, leaning on both elbows.	Front position.
"	Twisted left.	Good position.
Girl.	Sliding down. Shoulders twisted.	Forward, chest flat.
"	Twisted left.	Front, shoulders uneven.
"	Forward, feet crossed back.	Good position.
"	Forward on left elbow.	Forward, shoulders uneven.
"	Twisted. One shoulder higher.	Front, chest flat.
"	Good position.	Forward position.

The next chart, made under similar conditions, is typical of several reports.

Study. 11.40 A. M. Thirty minutes.

	Cloudy. 68°.	Fair. 68°.
Girl.	Pelvis front. Shoulders twisted.	Twisted.
"	Twisted, on one elbow.	Good.
"	Twisted.	Good.
"	Front, on one elbow.	Forward.
"	Legs crossed, one foot in desk irons.	Good.
"	Good.	Good.
"	Front, on one elbow, shoulders uneven.	Front. Chest flat.
"	Twisted. Shoulders uneven.	Front. Sitting on one foot.

*** Relation of Fatigue to Social and Educational Progress. Henry S. Baker.**

Hence, from the observations, weather certainly seems to affect posture. Because of the evenness of the temperature records, no idea as to its effect alone can be given. Likewise, the length of study or recitation period is so uniform that no effect upon posture is indicated except for these two lists, which are interesting because of the length and evident management of the period.

10 A. M. Grade II.

	Reading from board (3 min.).	Reading from books (5 min.).
Boy.	Elbows on desk. Feet crossed.	Shoulders rounded.
"	Bending left.	Sliding down.
Girl.	Good.	Good.
"	Twisted right, on one elbow.	Good.
Boy.	On right elbow. Feet in desk irons.	Good.
"	Twisted, on one elbow.	Absent.
Girl.	Absent.	Absent.
"	On both elbows. Shoulders forward.	Good.

Scientific investigation upon fatigue has shown that for most pupils the morning hours are better than the afternoon. But, so far as faulty position is concerned, it is not so much the time of day as the subject that affects the pupil's attitude.

Kotelmann tells us that languages, history and mathematics are most fatiguing because of the memory and reasoning involved. Nature work and geography, when illustrative, may be recuperative, while arts like drawing and singing are least fatiguing. I am unable to give illustrations of all the above subjects from the same class, but the two following reports would indicate somewhat of a coincidence with Kotelmann's view:

Grade IV. Record taken on different days.

	Picture lesson, 10 A. M. Fair (20 min.).	Music, 2.40 P. M. Cloudy (20 min.).
Boy.	Good.	Good.
"	Pelvis front. Shoulders twisted.	Good.
"	Good.	Good.
"	Twisted.	Good.
Girl.	Good.	Good.
"	Good.	Good.
"	Twisted.	On left elbow.
"	Good.	Good.

	Language, 2.40 P. M. Fair (30 min.)	Study, 2.40 P. M. Cloudy (20 min.).
Boy.	Twisted.	Twisted, on one elbow.
“	Twisted.	Good.
“	Good.	Good.
“	Twisted, on both elbows.	Good.
Girl.	Twisted, on one elbow.	On both elbows.
“	Chest flat. Shoulders rounded.	Sitting on left foot.
“	Absent.	Twisted.
“	Twisted, on left elbow.	Twisted.

Grade IX. Record taken on different days.

	Physics, 2.30 P. M.	Drawing, 2.30 P. M.
Boy.	Good.	Feet crossed.
“	Good.	Shoulders forward.
“	On left elbow.	Good.
“	Good.	Legs braced back.
Girl.	On left elbow.	Side position, knees crossed.
“	Good.	Twisted.
“	Good.	Side position, knees crossed.
“	Good.	Twisted.

Study, 2.30 P. M.

Boy.	Twisted, on both elbows.	Girl.	Twisted. On both elbows.
“	On right elbow.	“	Twisted. On right elbow.
“	Chest flat. Shoulders forward.	“	Good.
“	Absent.	“	On left elbow.

Statements made last year as to faultiness of posture in busywork or sewing are emphasized by observations this year as follows:

Grade I. Record taken from different classes.
Busywork.

	10.30 A. M.	11.30 A. M
Girl.	On left foot. R. knee in desk.	On right foot. Bent left.
Boy.	Twisted. On right elbow.	Bending left.
Girl.	Flat chest. Shoulders rounded.	Twisted. Bent left.
Boy.	Good.	Bent left. L. knee in desk.
		On elbows. Chest flat.
Girl.	Left knee in desk.	On elbows. R. knee in desk.
Boy.	Good.	Absent.
Girl.	Sitting on both feet.	Bending left.
Boy.	Flat chest. Shoulders rounded.	

3.30 P. M.

Girl.	On elbows. Chest flat.
Boy.	Chest flat. Shoulders rounded.
Girl.	On right foot. Leaning on elbows.
Boy.	Bending left. On left elbow.
Girl.	Twisted. Chest flat.
Boy.	On elbows. Bending left.
Girl.	Sitting on left foot.
Boy.	On elbows. Left knee in desk.

Grade V. Record taken from two different classes.

Sewing. 10 A. M. (One hour.)

Girl.	Good position.	Sliding down.
"	Sliding down. Twisted.	Sliding down. Twisted.
"	Sliding down.	Good position.
"	Twisted.	Twisted. R. shoulder lower.
"	Forward position.	Leaning on left elbow.
"	Sliding down. Twisted.	Twisted left.
"	Twisted. Chest flat.	Forward. Chest flat.
"	Sliding down. Twisted.	Sliding down. Twisted.

In sewing, the length of the period would be a strong factor in causing a faulty posture to be assumed. For sewing is required twice a week from the fourth to the ninth grades, and the period is at least forty-five minutes in length.

Many people believe that postures taken by pupils are unimportant, as one position tends to neutralize another. This question as to whether positions tended to become constant, or whether one faulty posture was succeeded by its opposite, was raised at the previous meeting. The following reports, selected almost at random, seem to answer the point. Each report covers the observations made upon the same pupil four times a day for the space of five days.

	10 A. M.	11.40 A. M.
Mon.	Twisted. Sliding down.	Twisted. Sliding down.
Tues.	Sliding down. Chest flat.	Forward position.
Wed.	Sliding down.	Sliding down. Bent left on left elbow.
Thurs.	Forward position.	Sliding down. Chest flat.
Fri.	Forward position.	Twisted. Bent left.

	2.40 P. M.	3.30 P. M.
Mon.	Forward position.	Twisted left. On left elbow.
Tues.	Sliding down. Chest flat.	Forward position.
Wed.	Front on elbows.	Sliding down.
Thurs.	Twisted left. On left elbow.	Forward position.
Fri.	Forward position.	Sliding down. Twisted.

This record for a boy in Grade IV shows that in the twenty observations he is noted as sliding down eight times and as being in forward position seven times. In the following observations from Grade VII, the girl is noted as twisted to the left seven times, as bent to the left twice, and as leaning on the left elbow four times.

	10 A. M.	11.40 A. M.
Mon.	Twisted. Bent left. On left elbow.	Good.
Tues.	Forward position.	On both elbows.
Wed.	Twisted left.	Good.
Thurs.	On both elbows.	Forward. R. shoulder higher.
Fri.	Good.	Bent left. On left elbow.

	2.40 P. M.	3.30 P. M.
Mon.	Front. On left elbow.	Good.
Tues.	Twisted left. Shoulders uneven.	Twisted left. On left elbow.
Wed.	Bent left. Right shoulder higher.	Good.
Thurs.	Good.	Twisted left. On left elbow.
Fri.	Twisted. Shoulders uneven.	Twisted way around in seat.

Hence, from these and similar reports, it is evident that pupils tend to assume a fairly constant posture during school hours; and, in all probability, many of the same attitudes are of frequent occurrence at home.

Among causes of asymmetry, the position in writing is considered important. Dr. E. R. Shaw has shown that, even with vertical script, the pupil may not have sat upright while writing. Yet he states that its adoption would lessen the frequency of fatigue scoliosis, especially if the teacher exercised care to keep the pupils rested and in good position. The influence of the teacher is of the utmost importance, for if vertical writing is to meet the claims made for it, its essentials must be required in all forms of written work. The reports show some faulty but many excellent positions in the writing lesson, but in copying or written work the faulty positions are very prominent. As an illustration, I present these charts from the same class. In regard to time and atmospheric conditions, the copying certainly had everything except the oversight of the teacher in its favor.

	Writing. Cloudy, 2.40 P. M.	Copying. Pleasant, 10 A. M.
Girl.	Good.	Twisted. On edge of chair.
“	Good.	Twisted. Feet in aisle.
“	Twisted. On left elbow.	On R. elbow. Sitting sidewise.
“	Forward. Shoulders rounded.	Forward. Shoulders rounded.
Boy.	Good.	Sliding down.
“	Twisted. On left elbow.	Twisted. Legs crossed.
“	Good.	Leaning on left elbow.
“	Good.	Twisted. On left elbow.

The effect of the oversight of the teacher is apparent in the following chart, in which the teacher is cited as being very careful about position during the literature lesson.

Grade IX.

	Literature, 10 A. M.	Arithmetic, 11.30 A. M.
Boy.	Good.	Shoulders forward.
“	Good.	Good.
“	Good.	Shoulders forward.
“	Feet in aisle.	On left elbow.
Girl.	Good.	Pelvis front. Shoulders twisted.
“	Good.	Shoulders twisted.
“	Good.	Good.
“	Good.	On left elbow.

	Literature, 10 A. M.	Arithmetic, 11.30 A. M.
Boy.	Good.	Shoulders forward.
“	Shoulders forward.	On right elbow.
“	Good.	Shoulders forward.
“	Good.	Sliding down.
Girl.	Good.	On left elbow.
“	Good.	Good.
“	Good.	Shoulders forward.
“	Good.	Good.

One of the Section members, in answer to a preceding question, suggests that girls rest themselves, up to a certain age, by sitting on the foot, when the unladylikeness of this and similar positions is so forced upon them that, in order to be comfortable, they take a twisted position. The boy rests himself by sliding down in his seat, and so, while he produces a flat chest, a twisted spine may not result. It is true that more girls than boys are affected with spinal curvature, the proportion being four or five to one. Fatigue caused by sitting posture may be a beginning of the difficulty, for the reports show faulty attitudes to be accentuated between the ages eight to thirteen. From Dr. Christopher's work in Chicago, it is known that the boy's endurance is always greater than the girl's; and that from the age of ten, this power increases more rapidly for the boy than for the girl.

Dr. Muller in his book urges that, "In order to amend the harmful influences of the school room, the mobility of the joints, especially of the spinal column, should be increased; and that the muscles, especially of the back, be strengthened." Mobility and strength come from freedom and action. Boys get this in their outdoor sports. Girls do not, except in tennis and in sports of a like nature; and to the majority of girls even these sports are denied. Hence it is not strange that more cases of asymmetry are found persisting among girls than among boys.

In conclusion, what are the points that this work has impressed upon the Section?

1. The need for properly constructed and equipped schoolrooms.
2. The importance of having educators realize the value of frequent change in work, whereby over-fatigue at least may be lessened.
3. The need for more time for physical training in the school session, and the necessity for providing vigorous outdoor sports, especially for girls, throughout the entire year.
4. The potency of the teacher who believes that the hygiene of childhood and adolescence is fully as important as mental development.
5. The necessity for cooperation with the home, so that teaching and practice may be in harmony.

ADDENDA.

Since the presentation of the report of the Boston Section, I have had access to "Annuales de Medecine et Chirurgie Infantiles." Beginning in May, 1901, there are three numbers giving an account of "Deviations of the Vertebral Column in the Schools of Lausanne," as observed by Dr. Combe, assisted by Dr. Scholder and Dr. Weith.

From actual tests, the author claims that the most common cause of scoliosis is vicious attitude, for which the predisposing causes are bad nourishment, bad air, feeble muscles, rapid growth with its attendant general weakness, and heredity. Speaking of the prevalence of scoliosis among girls, Dr. Combe asserts that the figures of orthopedists do not present all the aspects. For in primary schools, where the piano, embroidery, and painting is not added to the fatigue of the schools, both the author and Krug, of Dresden, find the proportion nearly the same for both sexes.

Combe, of Lausanne.

1,270 boys	297 scoliosis	23%
1,024 girls	274 "	26.7%

Krug, of Dresden.

695 boys	181 scoliosis	26%
723 girls	163 "	22.5%

In all their statistics, Combe notes the fact that at about twelve years there is an arrest of the frequency of scoliosis. May not this arrest correspond to what the Boston Section found? Namely, that between the ages eight to thirteen there was a notable increase of faulty positions in all schools.

From the following tables, Combe claims that development of muscle and vigor does not prevent curvature. Neither does he believe weakness to be a sure cause.

315 boys	Feeble muscles	82 scolioisis	26%
302 girls	" "	48 "	23%
210 boys	Strong "	62 "	27%
215 girls	" "	71 "	33%

But two conditions that affect the first seven years of school life are considered of the utmost importance. These are insufficient lighting, and the prolonging of position whereby the child, in order to rest himself, must take an asymmetric posture.

In the case of girls, Combe claims that their skirts increase the difficulty. For, with a tendency to rise from one side of the seat, the skirt folds present an extra force in causing the pelvis to incline itself and the lumbar column to form a convexity turned toward the middle of the desk. In this observation, it seems to me there may be possible explanation as to why the girls observed by the Boston Section tended to twist their trunks rather than to slide down in their seats, as did the boys.

Points in desk construction and position of material and body in written work are noted as important factors. But Combe finds the greatest difficulty to be the adapting of the desks to the varying heights of children even of the same age. Hence he concludes that yearly measuring, while most excellent, is insufficient in certain cases during certain years.

Then the article closes with a comparison of the attitudes of children in different writing positions.

	"Ecriture penche."	"Ecriture droite."
Nuremberg	24%	15%
Zurich	32%	12%
Munich	24%	15%
Wurth	65%	31%
Wurzbourg	28%	8%

Combe adds, "If the child is allowed to write as he desires, the figures will be found quite different." Thus the tendency observed by the Boston Section and indicated by the comparison between the writing lesson and copying seems to be confirmed.

LUNG DEVELOPMENT IN THE CHILD.*

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The prominence of affections of the lungs in various diseases, either as complications or primary elements, gives this organ perhaps a higher importance than any other organ in the body. The emphasis given to tuberculosis is not the result of a mere scare, nor is the fear of it to be characterized as a simple "phthisiophobia" without sufficient foundation. Statistics show the danger only too plainly, and until specifics are obtained for the cure of the various diseases the human race must resort to prophylaxis as its chief means of rescue. Even when cure is accomplished the result is obtained by attention to the individual as well as to the causative germ or agent.

It is not the intention of this article to discuss the degree to which pulmonary diseases are infectious, contagious or communicable, but, accepting the fact that the lungs are a fertile field for the cultivation and spread of infection, to note a few points in which we are lax in employing the ounce of prevention, relying too much upon the pound of cure, which, in many instances, is short in weight.

The individual is often forgotten in the eager pursuit of the respective causative germs. There are two elements to be considered in etiology and prophylaxis; the external agencies, and the individual himself. It is difficult to decide which is the more important. Pathological conditions always depend upon the relative strength of the infection and the infected. Were it not for the vital resistance of the human tissues against external invasion, our history would have been written long ago. Prophylaxis for all infectious diseases can be summed up in the one principle of weakening the invader and strengthening the invaded. Relatively too much strength is expended in weakening and destroying the invader, leaving the individual fearful and defenseless in the presence of his self-induced weakness. Civilization is thrusting upon us our coughs and colds, our contracted chests, enfeebled stomachs and weak limbs; and often the higher in the scale the weaker is the resistance. The veterinary hospital gets a majority of its inmates from the highly bred animals, not alone because of their higher value—hence the attempt at preservation—but also because of their lack of resistance. Dr. Forchheimer of Cincinnati recommends for infant-feeding, not the milk of the highly bred Jersey cow, but that of the common, long-horned, sturdy, resistant, mountain cow—for her power of resistance. All nature is aggressive and it merely becomes a question of what forces shall conquer. Why do so many infants die? Lack of resistance. Prophylaxis is of most value in infancy and old age where resistance is at a minimum. The larger the city in which the child has his habitat the less likelihood of his winning in the contest, not alone because the strength of invading agencies is increased, but perhaps even more because his own powers of resistance are minimized. In the schools of our large cities where brush, broom and dusting cloth effectually scatter any infection to all parts of the room and where children of all grades gather from all sorts of environment, we often find an ideal culture medium for infection. The value of space has crowded a large proportion of our city urchins into tenements where sidewalks and courts serve for playgrounds, where breathing space is at a premium, where the outlook is often so limited that the weakest arm scarcely dares to cast a pebble for fear of breaking windows, where echoing voices jostle each other in their struggle to reach the open air and where eyes accustom themselves to their narrow quarters and become near-sighted. Even where public parks exist, the omnipresence of the "keep off the grass" and the stealthy encroachment of public buildings often rob the child of his natural gymnasium. His life is crowded with "don'ts" until spontaneity of life is lost. Autopsy can pronounce his lung "a city lung" by the accumulation of soot; osteology distinguishes the country maid from the society lass; and pathology establishes her museum in the slums, where moral, physical and mental development are under the handicap. How far governmental interference is admissible or possible is a debatable question, but there is always one place where corrective and regulative measures are possible to a certain degree, viz., in the schools. Education should be more than a mental development of the child. The magnitude of the task of providing adequate facilities for gymnastics for the children is a serious obstacle, and yet the results would justify the attempt. Above all, children must be good animals. The blessings of a gymnasium are only too plainly seen by a comparison of the lung capacity of children in private and public schools. The advantage of the former, so far as development of the lungs is concerned, is enormous. The effects of a general physical culture on the body as a whole needs no comment. One of a series of tests[1] taken by the writer on the school children of New Haven was the determination of the lung capacity for the respective ages from 6 to 17 inclusive. The data are based upon 100 children for each age. These children were without the advantages of a gymnasium and regular training therein. The accompanying table and chart represent a comparison of these results with those taken by Dr. Wm. G. Anderson of the Yale Gymnasium from children in private schools near New York. His results represent an average of 600 children at each age from 6 to 15 inclusive:

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* Reprinted by permission from *The Journal of the American Medical Association,* May 31, 1902.

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[1] Studies from the Yale Psychological Laboratory, vol. ii.

Comparative Lung Capacities for Public and Private School Children.

	Boys.		Girls.	
Age.	Priv.*	Pub.	Priv.	Pub.
6	64	57.1	35	49.2
7	80	65.6	40	58.9
8	88	71.8	48	64.2
9	106	82.7	65	73.4
10	124	92.8	80	80.3
11	144	106.3	106	83.6
12	150	117.2	125	104.6
13	168	124.4	136	108.1
14	188	120.4	150	107.8
15	205	170.3	155	116.3
16	...	189.3	...	119.9
17	...	202.5	...	124.0

The children from whom his data were taken underwent a daily training in the gymnasium, and while on an average his children at 6 years of age had a slightly smaller lung capacity than the public school children, the increase in development of the former was so rapid that the children of the public school were soon excelled. At the age of 15, private school boys had a lung capacity of 205 cubic inches; public school boys only 170.3 cubic inches, the former having the advantage of 35.3 cubic inches. The average private school boy at the age of 15 had a larger lung capacity than the public school boy at 17. In girls the difference is even more noticeable, for at 6 the girls of the private school have a smaller lung capacity than those of the public school, but they develop so rapidly that by the age of 10 the private school girls have a larger lung capacity; and thereafter the rapid development continues so that at the age of 15 they have attained 155 cubic inches, while public school girls show only 116.3 cubic inches, the former having the advantage by 38.7 cubic inches. The average private school girl at 15 has 31 cubic inches more lung capacity than the public school girl at 17. The chart shows an enormous difference in the development of the two classes of children. Had the lung capacity been larger at all ages in private school children it might be argued that the private schools received the children of the better classes and those who had athletic ambitions, but when it is remembered that at 6 years of age the average lung capacity of private school children is less than that of the public school children, and that this relation is reversed within a year or two, the argument in favor of the gymnasium in public school work would seem convincing.

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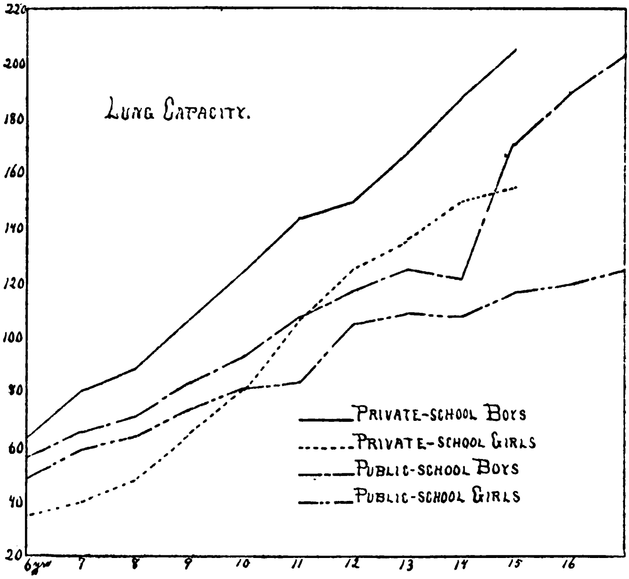
* Priv.—Lung capacity of private school children in cubic inches. Pub.—Lung capacity of public school children in cubic inches.

The relatively slight increase in the lung capacity for girls subsequent to the age of 12 would seem to be a significant criticism of the prevalent fashion of lacing rather than an indication that



development of the lungs as such had in large measure completed itself previous to that time. Remembering the contracted breathing of the phthisical patient, the above chart speaks loudly in favor of more attention to the physical in our schools. Mind and body are so intimately connected that neither may safely be neglected for the advantage(?) of the other. The value of deep inhalation is appreciated by insurance companies, for in all examinations they demand that the chest expansion be recorded; health resorts for the phthisical seek the places where the lungs can be thrown open, as it were, to the outside air; modern therapeutics in all lung diseases pleads for free ventilation and abundance of fresh air; every one knows that an organ in disease atrophies, and yet we seem afraid of taking long breaths; seldom do we find the necessity of raising our voices above the loudness required to be heard across the reception room, and, to add to the handicap, fashion binds upon us its fiendish inventions calculated to restrict our natural freedom. We seem to have forgotten the truth that in order to be good men we must be good animals. As a rule the acute infectious diseases are acquired and not inherited, and a great majority of diseases of the respiratory system can be traced to insufficient consumption of fresh air. I repeat—nowhere is prophylaxis of more value than in the child. "As the twig is bent," etc. The place to attack the problem is not in the chest that has already surrendered, but in our public schools, where every child for a number of years is to a certain extent under public control. Gymnasia are a poor substitute for the ball field, swimming hole and coasting hill, but let us arbitrate and compel the best terms possible from the civilization which refines to destruction.

THE EFFECT ON LUNG CAPACITY OF ARM MOVEMENTS DURING INSPIRATION.

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While one of the senior students was leading a class drill on the Swedish Stall Bars, in the spring term of 1901, he began breathing exercises while the body was partially suspended by the arms. When the drill was finished and the usual criticisms were being made, the advisability and possible good of breathing exercises in such a position were questioned by many of the class. This led to a general discussion of respiration involving arm movements during inspiration, and after a heated discussion and a free expression of opinion, the end of the class hour brought the matter to an unsettled termination without having arrived at any definite conclusion. After frequent discussions of this character, I determined to secure more facts bearing on the solution of this question.

To this end I instituted a series of experiments upon twelve men. This group was fairly representative in that there were men of one or two years' training in the school as physical students, others prominent in athletics and football, and still others who had received no training and possessed very sedentary habits. The following figures represent in cubic inches the capacity of the lungs taken with a wet spirometer, with the subject standing and the arms in the following positions:

(a) Arms at side in normal position.
(b) Raised to front horizontal or forward up.
(c) Raised to side horizontal or sidewise up.
(d) Raised to vertical or forward up to vertical.

That is, the subject begins to inhale as soon as he begins to raise his arms, and continues to do so until he reaches the position indicated above, when he will have inhaled all the air that he can possibly contain. He then forces the air into the spirometer and is allowed to place his arms where he will in order to expel all the air he possibly can. I observed that, in every case, the arms were dropped at the side in order to give the chest its greatest freedom and allow the muscles of expiration to contract freely.

OBSERVATION ON	A	B	C	D
Subject 1	230	220	220	215
" 2	226	210	220	200
" 3	310	300	300	295
" 4	286	250	250	268
" 5	218	208	220	212
" 6	282	258	258	236
" 7	210	196	198	196
" 8	230	218	218	228
" 9	182	168	168	172
" 10	220	218	218	210
" 11	270	258	268	264
" 12	276	270	272	262
Total	2,940	2,774	2,810	2,758
Average	245	231.16	234.16	229.83 cu. in.

Average difference between A and D, 15.17 cu. in.
Greatest difference between A and D, 46. " "
Least difference between A and D, 2. " "

These figures are fairly accurate, for three tests were taken and the average of the three recorded in the above table. By examining the table it will be observed that in every case A exceeds D, and on the total tests there is an excess of 182 cubic inches, giving an average advantage to position A of 15.17 cubic inches. The greatest difference between A and D is 46 cubic inches. This was obtained from a subject who had pronounced, deep, diaphragmatic breathing. He is remarkably well developed, is a good gymnast, and a good all around athlete. The least excess of A over D is 2 cubic inches. This was obtained from a young man who had marked superior costal respiration. He had never taken any systematic exercise, had practiced athletics very little if any, and his musculature was flabby and weak. By comparing these two cases, which represent the extremes of two conditions or types of respiration, the conclusion is that arm movements must affect the deep, rather than the shallow respiration, and that in some manner the free movements of the diaphragm and lower thoracic skeleton are restricted.

It is well here to consider the anatomical factors of forced respiration, and to discuss the muscles involved which also have to do with arm movements. For the following classification of muscles involved in forced respiration, I am indebted to Dr. W. S. Hall. (See Hall's Physiology, p. 199, Sec. B.):

Inspiration: (a) Upper ribs raised by (I) the three scaleni muscles, (II) serratus posticus superioris, (III) cervicalis ascendens; (b) sternum raised by (IV) sterno-cleidomastoideus, (V) sterno-hydoideus, (VI) sterno-thyroideus, (VII) thyro hyoideus; (c) hyoid bone raised by (VIII) mylo-hyoideus, (IX) stylo-hyoideus, (X) genio-hyoideus, (XI) digastricus; (d) shoulder girdle raised and drawn backward by (XII) trapezius, (XIII) rhomboidei major and minor, (XIV) levatores anguli scapuli; (e) lower ribs drawn toward the raised and fixed upper ribs by (XV) pectoralis major and minor, (XVI) subclavius, (XVII) serratus magnus.

Expiration: (a) Abdominal contents compressed and forced against the diaphragm by (I) obliquus externus, (II) obliquus internus, (III) transversalis abdominis, (IV) rectus abdominis, (V) levator ani; (b) ribs depressed by (VI) rectus abdominis, (VII) quadratus lumborum, (VIII) serratus posticus inferior, (IX) triangularis sterni.

From this concise and comprehensive classification of respiratory muscles, it is readily seen that the inferior costal region is governed by the pectoralis major and minor, the subclavius, and the serratus magnus. With arms in the normal position, there will be no difficulty to understand how these muscles perform the office to which they are assigned, but when the arms are raised to the front horizontal, for example, the situation is quite different. The scapula becomes a fixed point involving the office of all those muscles connected with it in order to maintain the fixation. This will bring force to bear directly upon the thoracic skeleton, for the rhomboidal major and minor connect the vertebral border of the scapula with the spines of the seventh cervical and the first, second, third, and fourth dorsal vertebræ; the anterior outer border of the scapula serves as the attachment of the serratus magnus, which has its origin from the anterior surface of the first seven ribs. This forms a contractile band extending from the anterior surface of the ribs to the dorsal vertebral spines, which, during its activity, brings an antero-posterior pull to bear upon the thoracic skeleton which tends to prevent the elevation of the ribs. Furthermore, there is the immense leverage of the arm brought to bear upon the scapula, which must be maintained principally or wholly by the serratus magnus, which greatly aggravates the antero-posterior pull before mentioned. If the arm be raised above the horizontal and brought to the vertical, this must be accomplished by the serratus magnus; thus not only must the leverage of the arm be sustained, but it must be moved upward against gravitation. This movement of the arms also has a greater or less tendency toward effort, or a fixation of the thoracic skeleton with a consequent impeded mobility. When the arms are moving upward, the pectoralis major and minor must be relaxed, and therefore they can exert no force upon the ribs that would tend toward elevation. With the effort to get the arms to the vertical position, the back muscles are actively contracted, with a tendency to arch flexion. This brings the abdominal muscles on a stretch, causing the viscera to be compressed and forced upward against the diaphragm, forcing it upward or in the least impeding its free descent. There is also the psychic influence, for the attention is divided; this, however, may be a very minor cause.

The advantage of the side horizontal over the front horizontal and likewise the raising of the arms sidewise up to vertical, instead of forward up to vertical, may be accounted for by the fact that the leverage is applied in a different direction so that it does not fall directly upon the serratus magnus, also the trapezius elevates the arm instead of the serratus magnus. However, this position also shows a marked decrease over the normal position, for in the normal position the individual will invariably raise the shoulder girdle during forced inspiration. This tends to oblique the pull of the serratus and the pectoralis upward, outward, and backward, with the effect that the ribs are pulled upward with a consequent elevation.

The old system of lung development was to increase the work of the chest muscles by various exercises and machines. Under this system the actual measurements of the chest girths rapidly increased, but it was found later, by experiments with the spirometer, that the capacity had actually decreased, the thoracic skeleton had become very much fixed, and that the increase in measurement was due to the contraction of the great mass of acquired chest muscles rather than to mobility of the chest wall. Thus, when an individual raises his arms and causes his chest muscles to contract, he becomes for the time being what the above individual is perpetually, and with a similar result as shown by the above experiments.

The difference in the capacities of positions A and D, though it may be considered small and of not much importance one way or another, is, however, of vital importance, and may be the very amount of air we need to accomplish our desired object. It is a well-known fact that lung tissue cannot be created by exercise, or at least by the demands made upon it by exercise. Therefore the object of every physical trainer is, by exercises of various kinds, to increase the demands made upon the lungs and so to bring into use every particle of lung tissue already possessed by the individual. Thus may be readily seen the fallacy of causing individuals to exercise briskly to create this demand, and then to give them breathing exercises in such a position that it is impossible for them to bring into use all their lung tissue. It is indeed like "lighting a candle and putting it under a bushel." A man is insensibly defeating his own purpose. That very difference may be the required amount to fill the cells in the apices and other outlying portions of the lungs, which in many persons are rarely used and consequently form a fitting location for tuberculosis, because from disuse the resistance is reduced to a minimum.

In conclusion, I would sum up the agencies causing a decrease in lung capacity when arm movements are used during inspiration, as follows:

1. Fixation of the scapula involving respiratory muscles.
2. Leverage of the arm.
3. Gravitation.
4. Effort or fixation of the thoracic skeleton.
5. Interference with the free movement of the diaphragm.
6. Psychic influence.

After careful observation and much thought, I would make the following closing statement: Lung capacity varies inversely with the height of the arms during inspiration.

A SELECT BIBLIOGRAPHY OF THE HISTORY OF PHYSICAL TRAINING.

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The following bibliography was prepared primarily for use in connection with a series of ten lectures which constituted one of the Harvard University Summer Courses in Physical Education in 1902. Its incompleteness is largely due to this fact, but even in the present imperfect form it may serve a useful purpose in the case of persons interested in the subject to which it refers. Titles bearing exclusively upon physical training have been carefully selected after examination of the best libraries in this country and on the Continent, and first-hand acquaintance with the sources. Books and articles of a more general nature are the best with which the writer is familiar, but doubtless others of equal or greater value have escaped his notice. Suggestions with regard to such omissions will be welcomed. Works in English are usually mentioned first, and those most generally accessible to students. Foreign titles are restricted to German and French sources as being the only ones open to the majority of readers. In sections where the literature is abundant, the most reliable, complete, or recent authorities are mentioned.

It is fitting that even so slight a contribution as the present one should contain more than a passing reference to the invaluable pioneer services of Dr. Edward Mussey Hartwell. His classic writings, backed by his scholarly and commanding personality, have been among the most potent forces in arousing interest and disseminating right conceptions of the nature of physical training. In this country he was the first to reveal the rich history and literature of the subject, and it is with the respect and affection due from a pupil to his master that the writer acknowledges here his own indebtedness for the impulse to enter what has proved to be a fascinating and fruitful field of investigation.

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REPORTS FROM SOCIETIES.

PHILADELPHIA BRANCH OF THE A. A. A. P. E.

The December meeting of the Society was held on the fourteenth day of the month at Drexel Institute. The program, which was most interesting and greatly enjoyed by all present, was as follows:

"Visceral Ptoses" and "Diseases which indicate and contra-indicate Exercise," Dr. J. Madison Taylor, Philadelphia, Pa.
"The Therapeutics of Gymnastics," Dr. Jay W. Seaver, Yale University, New Haven, Conn.
"Some Graphic Methods in the Measurements of Body Deformities," Dr. Walter Truslow, New York City.

Light refreshments were served by the entertainment committee in the Gymnasium to the members and their friends.

The officers for the year 1901-1902 are as follows: President, Dr. J. A. Babbitt; 1st Vice-President, Miss Maude G. Hopkins; 2d Vice-President, Dr. Louisa Smith; Secretary, Miss Esther Kuhn; Treasurer, Dr. C. E. Ehinger; Council, Prof. Richard Pertuch, Dr. Grace E. Spiegle, Miss Evaline Young.

ESTHER KUHN, Secretary.

PHYSICAL EDUCATION SOCIETY OF NEW YORK AND VICINITY.

The annual meeting of the New York Society was held at the West Side Branch Y. M. C. A., December 21, 1901, with Dr. Walter Truslow in the chair and twenty-five members present. The minutes of the previous meeting were read and confirmed.

The Secretary reported as follows: Meetings held during year, 6; average attendance, 35; number on roll January, 1901, 110; resigned, 7; failed to qualify, 7; new members elected, 30; total enrollment December, 1901, 126.

The Treasurer reported: Cash in hand January 1, 1901, $88.50; received during year, dues, etc., $238.02; paid during year, general expenses and dues to A. A. A. P. E., $209.94; balance in hand, $116.58.

A special committee, consisting of Dr. Welzmiller and Dr. Truslow, was appointed to confer with the national body as to the desirability of changing the date of the annual meeting.

Dr. Crampton proposed that the meetings during the months of November, December, February, March, and May be held in the afternoon, and the January and April meetings in the evening. Carried.

A special committee was appointed to ascertain the various places in the city and vicinity that are engaged in any form of physical education work, and report on the same.

The following were elected to form the Executive Committee: For the year 1902: President, Dr. Mary Taylor Bissell; 1st Vice-President, Dr. L. R. Welzmiller; 2d Vice-President, Miss R. B. Peck; Secretary-Treasurer, Alex. E. Wilson Barker; with Dr. Walter Truslow, Miss Mae H. Beattys, Dr. Thos. D. Wood, Mr. George T. Hepbron.

ALEX. E. WILSON BARKER, Secretary.

NEW HAVEN SOCIETY.

A meeting of the A. A. A. P. E. of New Haven was held Thursday evening, January 16, 1902, in the Trophy Room of the Yale Gymnasium. The speaker of the evening was Mr. Hans Ballin, Physical Director of the Hartford Turnerbund, who spoke upon "The Necessity for American Gymnastic Societies." A very spirited discussion followed, Dr. J. W. Seaver, Rev. B. B. Brown, and Dr. E. H. Arnold participating.

A business meeting followed the discussion, when the following new members were proposed and accepted: Gladys Von Witke, H. Louise Livermore, Louise Wright, Edwin H. Tuttle, Chris. Kogel, Willard A. Sanford.

The annual election of officers resulted as follows: President, Mr. Louis Leyerzapf; 1st Vice-President, Dr. E. A. Arnold; 2d Vice-President, Mr. Chris. Kogel; Secretary-Treasurer, Miss Carrie Grumman; Council, Dr. J. W. Seaver, Dr. W. G. Anderson, Mrs. Eugene Buckman.

CARRIE L. GRUMMAN, Secretary.

REPORTS OF THE COUNCIL.

January 11, 1902—Present: Drs. Taylor, Wallin, and Gulick, Miss MacMartin, Miss Beiderhase, Miss Bancroft, Mr. Bolin, Mr. Haug.

The minutes of last meeting were read and approved.

The following persons were elected to membership: Dr. Snow, Miss Anna Berlin, Miss Mary A. Reed, William H. Ball, S. A. Lewis, J. Edward Grant, Dr. Thomas D. Wood.

The resignation of Dr. John W. Tilden was accepted.

On motion of Mr. Bolin, the dropping from membership of eighty delinquent members according to the constitution was postponed until after the publication of the delayed numbers of the Review.

The Treasurer's report, showing $36 on hand, was accepted.

The report of the Editor of the Review, showing progress, was accepted.

The report of the President, on a new plan for raising membership dues and fostering local societies, was received. Definite action upon it was deferred.

The President and Treasurer were appointed a committee to receive delegates from the New York Physical Education Society for a conference as to a change in the fiscal year of the latter organization.

The Council adjourned to meet the last Saturday in March.

JESSIE H. BANCROFT, Secretary.

March 1, 1902—Present: Drs. Savage and Gulick, Miss Beiderhase, Miss MacMartin, Miss Bancroft, Mr. Haug.

The minutes of the previous meeting were read and approved.

The following persons were elected to membership: Dr. H. V. Barclay, E. M. Butler, Edna Edmunds, J. L. Hanrahan, Sophie S. Hogan, M. Jacobs, Chas. Kimble, J. L. McBride, Bessie K. Marsh, E. C. Mangan, Albert Turner, Grace B. Turner, Anna Morgan, May Pettitte, Elsa Pohl, Edwin H. Tuttle, May White, Louise Wright, A. G. McKenzie, Georgiana Richardson, Elizabeth Conrad, Dr. Max J. Walter, Margaret M. Wagner, Philip J. Weiss, Joseph Henry Harrison, Rebecca Lessor, Emmett D. Angell.

The following resignations were accepted: Dr. David M. Wells, Miss A. M. Carr, Miss Rebecca Kite.

The Treasurer reported that there was $20.65 on hand.

The editor of the Review presented the June number as a report of progress. Accepted.

Miss MacMartin moved that the delayed numbers of the Review be printed in single numbers and issued if possible at the rate of one a month, from date, until schedule time for them be again reached. Adopted.

Dr. Gulick moved:

1. That the subscription price of the Review be made two dollars ($2) per annum.
2. That membership in the American Association for the Advancement of Physical Education, including the Review, be made two dollars ($2) per annum.
3. That all dues be sent by members directly to the Secretary of the National Association.
4. That the National Association remit, through its Secretary, to local societies which are affiliated with the National Association and which are active, one dollar ($1) for each member who has so paid. An active society shall be considered one which has held at least four public meetings during the preceding year and sent reports of same to the National Council.
5. That local societies shall arrange their own dues with members who are not also members of the National Organization. Members who pay dues only in the local societies shall not be entitled to the Review.
6. That the dues of members of the National Association who are not also members of local societies shall be retained in full by the National Association.
7. That these regulations take effect January 1, 1903.

Passed.

On motion of Dr. Gulick, the President was requested to communicate with local societies with reference to the next National Convention and to report at the next meeting of the Council a definite proposition as to a place for holding the next convention.

On motion, the Council adjourned to meet on April 12th.

JESSIE H. BANCROFT, Secretary.

Amer. Physical Educ. Review
Mar. 1902

EDITORIAL NOTE AND COMMENT.

Through an unfortunate error in the December issue of the REVIEW, Dr. William W. Hastings' article was made incomplete by the omission of one important chart which should have been inserted in conjunction with Table IV. (opposite page 285) to illustrate page 285. We print the chart in the hope that our readers will insert it where it belongs in the December number.

The next convention of the association will be held under the auspices of the Michigan branch of the society in the spring of 1903.

ABSTRACTS.

The Importance of Precision and Accuracy in Gymnastic Positions and Movements.—Prof. L. M. Torngren writes on this subject in Tidskrift i Gymnastik, Stockholm, for 1901. He first considers the necessity of physical development through systematic gymnastics, especially in schools where children are confined for a long time to their seats; and also the necessity for a provision by school authorities of sufficient time for gymnastics. Further, that all the time assigned for the gymnastic lesson should be utilized to the best advantage by the teacher, and in such a way as to contain all the forms of movement necessary for the physical development of the child. One of the most effectual means to secure this, as well as to make it of greatest usefulness to all, is by strict attention to accuracy of form in all positions and movements used. Accuracy brings out the ability to make use of all the bodily powers, bringing muscles into activity that would not be used in faulty, careless positions, and on the other hand preventing their action when they should remain inactive. (He takes as an example a bending backward of the body with arms extended. The bending—if rightly done—should take place in the upper part of the spinal column, and not, as is the case in a faulty position, in the lower part, when the strain comes upon the abdominal muscles and the flexmuscles of the hip joint.) The greater the accuracy, the greater and stronger the effect of each movement, and there is in itself a progression in the observation of correct form. Progression ought to be an increase of that which is essential in each exercise, but not necessarily an increase in the quantitative work as a whole. Accurate execution of the exercise and correct progression are indispensable for correct carriage, and also for its importance in affecting the respiration, circulation, and enervation. The teacher, as far as the time allows, ought to bring out the beautiful as well as the useful in the exercise, so as to develop the sense of the beautiful in the child. He ought to show how usefulness and beauty combine in properly directed exercises, because it will interest the children and teach them to see the advantage of exercises taken in good positions over those taken in bad, careless positions.

What is said about pedagogic gymnastics holds good in medical gymnastics, military gymnastics, and fencing. It is the correct form and accuracy in the movements and positions that, in fencing, as in all kinds of gymnastics, gives the greatest agility and strength combined with least effort.

M. K. W.

The Terminology and its Importance in Gymnastics (Anna Eklof in Tidskrift i Gymnastik, Stockholm, for 1901).—The writer considers the terminology in Swedish gymnastics of great importance. Without it, it would not have been possible to put the gymnastics into a system. Had not the names of movements and positions been invented (a thing for which Branting at the time was much ridiculed), it would not have been possible to classify them in groups or to give expressions for progression. Nor would it be possible without terminology to clearly explain or teach Swedish gymnastics in foreign lands. It is more than a question of language: it is one of gymnastics as well, because. translated, it can be fully understood only by a person educated in the subject. The terminology should not be considered a side issue. Miss Eklof considers it important to work out the Swedish terminology as well as possible in other languages, in order to promote a better understanding of, and prevent indifference to, the Swedish system.

M. K. W.

BOOK NOTICES AND BIBLIOGRAPHY.

PHYSICAL TRAINING: SUPPLEMENT TO ASSOCIATION MEN, by Luther Gulick, M.D.; issued bimonthly at 3 West 29th street, New York, at $1 per year. Vol. I, No. 1, November, 1901.

This supplement to Association Men contains the first of a series of papers on gymnastic therapeutics by Dr. Gulick, who possesses the secret of treating a subject scientifically and at the same time adding to its interest and practical value. The papers are founded on personal experience as well as on theoretical knowledge, and are the most attractive and best presentation of the subject known to the writer. To anyone who is concerned with the treatment of ill health by therapeutic exercises, they are well-nigh indispensable.

H. L. T.

TIDSKRIFT I GYMNASTIK, STOCKHOLM, 1901.

The Main Features of Tabes Dorsalis, with Special Reference to the Ataxia and its Treatment by Medical Gymnastics, by Sven Wallgren. The Importance of Precision and Accuracy in Gymnastic Positions and Movements, by L. M. Torngren. About Angina Pectoris, by W. von Alfthan. The Terminology and its Importance in Gymnastics, by Anna Eklof. The Gymnastics at the Sport and Gymnastic Festival in Copenhagen, June 25—30, 1901. Reports of the Meetings of the Society of Scandinavian Gymnastic Teachers for 1900 and 1901. List of Members of the Society of Scandinavian Gymnastic Teachers.

NY TIDNING FOR IDROTE, STOCKHOLM, 1901.

A magazine entirely devoted to sport, hunting, horse racing, and yacht races.

THE POSSE GYMNASIUM JOURNAL, NOVEMBER, 1901.

This number has an editorial comment upon the happy choice of Dr. Luther Gulick as Editor of the Physical Education Review, giving a short sketch of his life and work. Other contents are: A Brief Exposition of the Types of Exercises in Swedish Gymnastics. Foreign Notes. School: leisure (concluded). In Memoriam. For the Cause of Physical Training. The Latest Rules for Football.

M. K. W.

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JUNE, 1902.

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INTEREST IN RELATION TO MUSCULAR EXERCISE.*

LUTHER GULICK, M.D.

Before discussing the topic of the hour, it seems necessary for me to state clearly the standpoint from which I speak. The standpoints from which we discuss physical training may be classified into three groups—physical, psychological, and sociological—as shown on the diagram:

Standpoints from which to view Physical Exercise.

1. Anatomical } Physical.
2. Physiological } Physical.
3. Neurological } Physical.

4. Intellectual } Psychological.
5. Emotional } Psychological.
6. Voluntary } Psychological.

7. Social traditions } Sociological.
8. Social feelings, etc. } Sociological.

In the physical group we may discuss exercise from the standpoint of anatomy,—its relations to structure of muscles and joints, the limitations and possibilities of movement incident to the nature of the structure itself, etc. Again, exercise may be discussed with reference to the functions of the various parts of the body,—the effects of exercise upon the functional capacity of muscles and joints, on gland and ligament. Or, in the third place, we may discuss the relation of exercise to the growth and the development of the nervous system. These all relate definitely to the physical.

In the psychological group we may discuss the relation of physical training to intellectual life. We may discuss the functions of the motor areas. We may attack the problem of motor thinking. This we will call the intellectual side. We may discuss, again, physical exercise from the standpoint of the emotions, and under this head we find the topic of the morning: "Interest in its relation to muscular movement." We might go on to discuss the relation of the great basic emotions of our race in the plays and games of our kind, and still be within the limitations of the emotional aspects of muscular exercise. We might proceed to discuss exercise in its relation to the will. Thus, under the psychological division we should have three sub-headings,—the intellectual, the emotional, and the voluntary. Many sub-headings suggest themselves as being under the sociological division. We might discuss the propagation of plays from generation to generation in terms of social tradition. We might discuss the relation of cooperative play to the development of social feelings and to the development of cooperation, and thus be in the realm of social feelings.

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* Read before the A. A. A. P. E. Convention, New York City, 1901.

Any scheme of physical exercise to be adequate and complete must meet the conditions incident to these various standpoints. Exercise must be suitable from the standpoint of anatomy; it must be in accordance with what we know of the laws of physiology and neurology; it must certainly be in accordance with the fundamental conditions of our intellectual, emotional and voluntary life, and, to be permanently effective, must meet the conditions of our social life. Any scheme of gymnastics or physical training built purely upon anatomical or physiological grounds must, in the nature of the case, ultimately yield to that work which is equally good from these physical standpoints but which also reckons with the laws of the higher organism.

The question of the hour is as to why certain exercises are more interesting than are others. Why is it that, to the average boy, it is more interesting to throw a stone at a bottle floating in the water than it is to pull a chest weight? Why is it more interesting to run a race than it is to lie on the floor of one's bedroom and take deep breathing exercises?

Certain great coordinations of muscular activities with psychic states have arisen during the progress of the early ages of man's history. These coordinations are so consistent as to be uniformly interpreted among all intelligent beings. That contraction of the facial muscles that we commonly call a smile is so usually associated with pleasant psychic states that we almost invariably associate pleasant psychic states with a smile. Expressions of anger, of sorrow, of delight, and of love have a sufficiently well defined and recognized form of expression to justify us in assuming the existence of a more or less definite psychic state wherever we see these particular muscular coordinations. This physical expression of emotion is intelligible to children before language is understood or spoken; between races whose origin is so far removed from each other as to render not only speech but mode of thought different; and even, to some degree, between different species of animals. These expressions of emotion include the activity in a more or less definite form of most of the muscles of the body, for even the unstripped muscle fiber of the intestinal tract by its form of activity expresses emotional states. The activities of many glands are also expressive. Thought and emotion are expressed most delicately, so far as we ordinarily observe, with the face and hands, but even the great muscles of the spine are associated in their activity with emotional states. Discouragement is usually expressed by a slight bending of the spine forward, a drooping of the head, while joy and confidence are shown by the holding of the spine and the head erect.

We may not say that these emotional expressions are involved in the nature of emotion itself. They seem to have arisen at least partially by a utilitarian process. The expressions of fear in the individual are such as would help him to escape or to overcome the object feared. Fear tends to make us flee, or to remain absolutely motionless awaiting an avenue of escape, or to fight. We may fairly assume that fear has manifested itself in many individuals in other ways than these, but the constant operation of natural selection has tended to perpetuate those individuals in whom the manifestation of fear has taken forms that are useful to the organism. We do not mean that the activity of specific motor areas is of necessity associated with specific states of mind. The real association is a process of far greater complexity than this. For coordinations are made, sequences of movement are involved, that include sometimes the whole individual for complete expression.

Thus far we are on ground that will perhaps be generally conceded. There is another aspect of the matter about which not much has been said. These bodily activities tend to associate with themselves the psychic states which they usually represent. Thus, if one who through discouragement is walking along slowly with dejected attitude will stand erect, raising the head (drawing it backward), and step more rapidly, there will be found a tendency toward the improvement of the feelings. If one who is worried or excited, who is making the short, nervous movements characteristic of this state of mind, deliberately makes long, slow movements in walking or in speech, it is common to find a similar reflex effect.

These muscular coordinations that express emotion are acquired by the individual with great ease. We are not prepared to say that they come to the individual purely by growth without practice, but we are safe in saying that he develops them with exceptional ease. The organism inherits peculiar capacity and inclination towards these particular adjustments. The process of learning these expressions of emotion, most of which come during the early years of life, involves, we believe, little if any conscious effort. Indeed the conscious effort to express emotion may be in itself a large element in inhibiting the true expression of the emotion and the substitution for it of that which is recognized as imitation. We do not need to take sides in the Weisman controversy as to the origin of these instincts and tendencies. It might be true that our fathers have made these specific muscular coordinations so long that we inherit, so to speak, their habits, and thus easily make these adjustments. Or, we might say with the followers of Weisman that there has constantly been a process favoring the survival of those whose emotions were expressed in these useful ways. If by physical training we mean the conscious effort toward the complete development of the physical self, this matter of the ripening of the neuro-muscular apparatus that expresses emotion becomes a matter of the greatest concern. The significance of this with reference to physical training we must leave until later in this paper.

Not only, however, in the expression of emotion do we inherit from our ancestors the tendency toward definite muscular coordinations, for other coordinations as well are evidently racial in their origin. Let me illustrate this by a brief discussion of throwing. It is a matter of common observation that men ordinarily do not throw in the same way that women do. The current explanation is that the ligaments in a man's shoulder allow a larger freedom of movement than do those in the woman's shoulder, or that the muscles actuating the upper arm are arranged differently in the man, thus permitting a movement in the one that is not permitted in the other. In so far as there are differences in the shoulder joint between man and woman, these differences are in favor of the woman. The ligaments in the shoulder joint are not so short nor so strong in the woman as in the man. Thus the woman has greater freedom of movement in the shoulder than has the man. The origin and insertion of muscles of the shoulder is the same with the woman as with the man. Men throw with their left arms in the same way that women ordinarily throw with their right arms. No matter how much skill the man acquires with his left arm, the character of the throw usually remains essentially like that of the woman. I have seen a man who could throw 250 feet with his left arm and as accurately as with his right arm. He was naturally right-handed, but his right arm had been injured. In order to continue to play first base on his college team, he learned to throw with his left arm. His left-arm throw, however, remained the woman's throw. Thus we see that the cause of the difference cannot be due to muscular or ligamentous differences between man and woman.

Let us now endeavor to find an explanation in the history of man's development. During the earlier ages of evolution, man's capacity to hunt and fight were large elements in determining his fitness to live. They were far larger elements in his life than the same capacity in the life of woman. The capacity to produce and care for young seems to be basal to the female, corresponding thus to the capacity of the male to hunt and to fight. During these early times those having the capacity to use clubs as weapons and to throw stones as weapons was important. The individual who possessed the capacity to throw the hardest and straightest would stand the best chance to overcome enemies and to kill game. The same may be said in regard to the use of the club. The man who could strike with the greatest speed and accuracy would stand a better chance of survival than his antagonist or competitor. Thus the succeeding ages of prehistoric times operated toward the constant selection of those who had in the largest degree this capacity to throw and to strike. This specific selection, however, would be constantly on the male side. The female was, during these same ages, being selected for survival mostly with reference to the domestic instincts. Thus there have arisen divergent emphases in the two sexes upon muscular coordinations. We are the descendants of those men who could throw and could strike, and of those women who loved children. Thus boys turn with ease to games involving throwing and striking, while girls' games emphasize more the rehearsal of domestic activities.

We should expect, in accordance with this theory, that occasionally there would be women who would inherit the distinctly masculine habit of throwing. This we observe to be the case. I have seen one little girl five years old who threw with a perfectly masculine swing. On the other hand, we should expect occasionally to find men who could not throw in the man's way. This also we find to be the case. We should also expect sometimes to find the neural throwing mechanism perfect on both sides of the body, in which case the individual will be able to throw with either arm. This also we have seen. Two brothers were at the same time pitchers on two teams, one in college and one in the high school: Each of them could throw hard and straight with either hand. It is said by some that this matter of throwing is purely a matter of training. I have seen little boys, three years of age, throw perfectly. On the other hand, I have worked with patience and persistence to teach girls to throw and have succeeded so far as a reasonable degree of accuracy and speed is concerned, but have never yet been able to achieve a genuine man's throw in girls. I do not mean to say that a woman cannot learn to throw. I do mean to say that a boy's neural mechanism is adjusted so that he learns to throw with much greater ease than does the usual girl.

If we view our nervous system, in the light of this illustration, as being more prone to organize with certain muscular coordinations than with others, I believe we shall see it in its true light. All these coordinations that have been of use in the history of the race come to us without difficulty. Where there has been a sex differentiation, as for instance in throwing, then the nervous system of each sex usually takes on its sex characteristics as truly and as differently as the body takes on its secondary external characteristics,— e. g., hair on the face of the man. These racially developed tendencies toward definite neural organization include, as I have suggested, all those activities that are of fundamental and genetic importance. If we assume, as we certainly must in the light of modern neurology, that in the species intelligence has developed coordinately with the capacity for complicated muscular movement, we shall be prepared to admit that, in the somatic development of the individual, a rehearsal in these respects of philogenetic history is an essential element in the development of rationality. In other words, finding that intelligence has developed coordinately with certain great muscular coordinations, we must assume that as the individual develops intelligence, he can best do it, pari passu, with those muscular coordinations that have a racial setting. This, I take it, is one of the major ways in which physical training comes into relation with the development of mental activity.

This conception is basal to our idea of motor thinking. We do not think in terms of heterogeneous and unrelated motor activities. We think in terms of definite motor activities that have long been associated with more or less definite psychic states. The individual follows racial steps. To only a slight degree does he hew out new coordinations for himself. This conception of physical training as bringing to the individual capacity for those motor coordinations that have been basal in the life history of the species is, possibly, as new in theory as it is old in practice. If we study the spontaneous activity of the young of intelligent beings, we do not find them making all the muscular coordinations possible. We do not discover that every joint is being moved in every possible relation to every other joint. There is much experimentation, but the racially old is seized by the individual with ease and joy. The puppy plays in a way to make his life complete. This differentiates his play from that of the cat. Each rehearses his own racial history. It appears that this same kind of psychic accompaniment obtains in the individual as originally obtained when this motor reaction was being developed in the race. The hunting and fighting instincts appear to be dominant in most of the plays of boys, and the domestic in most of the plays of girls.

In the training of most individuals as done by nature we see the successive epochs of muscular achievement of the race mirrored with essential faithfulness, coordinated step by step with the original psychic accompaniment. Physical education, then, from this view point, consists in giving to each individual in correct sequences those plays that will give him both the muscular coordinations toward which the organism is inclined and that emotional experience that makes toward full life and character. Adult complex coordination of muscle is not possible without the basal simpler coordinations that are learned early in life. So with the psychic life, the early psychic states must be thoroughly lived out in order that they may form the solid background of highly refined feeling and action. All movements may be studied with reference to their psychic content, as well as from other standpoints.

The great interest that centers about plays and games is at least partially because they are racially familiar; they have old coordinations. Fashions in games change, but they are only changes of form. They all depend on old notions and include only old neuro-muscular activities.

Let us turn now for a few moments to examining the chief forms of exercise taken by our kind,—football, baseball, hunting, fishing, racing, golf, tennis. These each represent certain muscular coordination. They are exceedingly old. Baseball is a complex of elements all of which date back certainly to our pre-human ancestry. The ability to throw a stone with accuracy and speed was at one time a turning factor in the struggle for survival. The non-throwers were largely eliminated at that stage in the world's evolution. Those who can throw and who are interested in throwing are left. The early man who could seize a bough of a tree and strike with accuracy and great power was better fitted to survive in the brutal struggle of those early days than the man not so endowed. He could defend his family better, he was better fitted for killing game, he was better fitted for overcoming his enemies. The ability to run and dodge with speed and endurance was also a basal factor. It was basal to hunting, it was basal to fighting, so that the runners have survived and the non-runners have been eliminated. Not merely those who can in times of stress carry on these activities with proficiency, but those whose interests have been connected with them have been the more fit to survive, because, by means of these preliminary exercises of the play activity, there has come a perfecting of the organism so that when the serious business of adult hunting and fighting has come, it has discovered a tried organism ready to do the work. So, great games have gradually grown during the development of our kind, from simple practice-throwing at a mark to the most modern form of baseball. Let not the comparatively recent date of the formulated game in its present form blind our eyes to the fact that in all countries of the world among rational human beings these games depending upon hard, straight throwing, rapid running, and accurate, hard hitting with a club are prominent. They tell of the early pre-human ancestral activity when life itself was dependent upon these abilities.

One of the figures at which I never cease to wonder, but which every summer appears in unceasing variety, is that of the fisherman—the intelligent, rational, city business man who, when he wishes rest and delight, will revert to the country, seat himself beside some convenient water, and fish. He may catch fish or he may not, but the long hours of the day will be spent in watching the line. The fishing is not done because the man needs the fish nor, so far as I can ascertain, for any reason which is related to the present environment, but because this fishing activity is built upon interests which date back to time immemorial. We are the descendants of fishermen. The delight in this form of activity may remain with us so long as life endures on the face of the world, because through the long ages the non-fishermen were eliminated. Early life was by the side of the water. Food supply was most readily secured and continual to the successful fisherman. The fisherman was more fitted to survive, and so the fishing interests dominate us even during these ages that are so far removed from that elementary time.

And so I might go through the whole catalogue of modern sports and show that they are built in the main upon these essential elements of which I have already spoken. The coordination of all the essential interests are old; the desire to beat, to win, is an old desire, and no amount of teaching that we shall love our neighbors and prefer them to ourselves succeeds in removing from the boy the desire to win at marbles or baseball, or takes away from him the keen fundamental delight in a hard fight.

Those of us who accept the general proposition that the abilities which have come to the race through the long ages of evolution are those upon which the character of the individual must fundamentally be built, will, I am sure, recognize the cogency of the argument that in the development of the boy those forms of activity are most important which relate to these old psychic interests. It is not enough that the muscles of the boy shall be developed. It is necessary that these muscles be coordinated in definite ways. DeLaspe was wholly off the track when he built a system of calisthenics upon all the possible combinations of the various joints of the body. Motor thinking and the development of rationality are not related to indiscriminate muscular activity, but are related to those forms of activity that have been basal in our kind. Exercises with the hands and with the face, with the tongue and with the lips, involve the activity of motor areas which have been associated with the development of intelligence; but we cannot believe that the training of the feet by juggling and in similar ways would conduce to the development of intelligence as does the training of the hand and eye. So that any plan of physical training which aims to be useful from the psychic standpoint must take into account not all possible muscular coordinations but those great basic activities which have always been associated in our time with the development of the rational life and the emotional life.

This view-point is presented as an important, although not as the only essential, one to take in the construction of curricula of neuro-muscular character in education.

I have endeavored to show

1. That there are relations between certain muscular contractions with definite emotional states, as well as the converse.
2. That we inherit, also, tendencies toward other muscular coordinations that have been of great racial utility.
3. That both these coordinations of muscle are acquired by the individual with great ease and joy.
4. That these racially old coordinations are basal in neural, rational and moral development.
5. That athletic sports and games are chiefly composed of racially old elements.
6. Hence physical training should pay great attention to phylogenetic muscular history and chiefly emphasize racially old coordinations and interests.

PRINCIPLES UNDERLYING PHYSICAL TRAINING.*

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"The object of the Physical Work is to provide an opportunity for men to secure that physical development and training without which the highest mental and moral efficiency are impossible."

This statement epitomizes the theory which the speaker holds of the purpose of the physical work of the Young Men's Christian Association. We shall attempt in this paper to outline this theory, justify its propositions, show its applications, and demonstrate its value as one of the fundamentals of what we believe to be the true function of the Association as a factor in solving the problem of modern city life.

The primary assumption of our theory is that the highest mental and moral efficiency are impossible without an adequate physical development and training. Not that such a physical development and training will be a guarantee that the subject of it will be a scholar or a Christian gentleman, but the character of one's conduct is determined by his thinking,—"as a man thinketh, so is he,"—and his efficiency as a thinking being is determined by the kind of brain and nervous structure he received from his ancestors, the training that is given these during the periods of their growth and development, and the condition in which they are kept; and this condition and training are dependent primarily upon the individual's nutrition and the nature of his muscular activities.

The modern theory of the relation of body and mind is that both are distinct entities, but that in some manner as yet unexplained, and probably never to be explained, they are so interrelated that any activity on the part of either involves a corresponding activity on the part of the other. This hypothesis is at the other extreme from that held for so long in the earlier history of mankind, that the body and mind had no organic relation, the body being considered but the dwelling place of the mind, acting as a restraint upon the freedom of the spirit, tending in all its influences to produce evil effects and to drag the spirit down. A corollary of that belief was that the body should be scourged and maltreated and kept in thorough subjection, lest the animal triumph and the supremacy of the man be overcome (1).* The present theory is also opposed to that of the materialist which so largely prevailed during the earlier stages of the development of experimental science, that mind can be reduced to material terms (1); or, as it has been expressed, "the brain secretes thought as the liver secretes bile."

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* Read at Y. M. C. A. Conference, Mountain Lake, Md., June 12, 1902.

This modern theory, founded upon observation and experiment, considers the nerve cell the sole instrument by which the spirit expresses itself in the material world, and "if there be any deficiency of the neural elements which constitute the means for this physical exhibition of a non-physical order of being, then mind simply cannot manifest itself at all, or only in a manner we call defective or abnormal" (1). If, now, there is this close relation of body and mind and the spirit of man is dependent for its expression upon this material body, and this alone, and the quality of that expression and therefore of its influence upon man varies with the condition of the body, it is of the utmost importance that an organization which has for its object the making of Christian men shall understand the factors favoring the perfect condition of the body and shall make provision for securing such condition in proportion to the importance thereof.

The relation of mind and body presents at least three phases for our consideration:

1. *The physiological aspect.* Perfect health is absolutely essential to the highest mental and moral efficiency.
2. *The psychological aspect.* The development of the brain and the range of one's psychic activities are related fundamentally to the nature of one's early motor experiences.
3. *The sociological aspect.* The foundations of the religious life, both in its individual and its social phases, are determined by one's muscular activities in boyhood and young manhood.

The physiological aspect. A man's value is measured primarily by the amount of energy he can produce. Now it is a matter of common observation that one cannot produce energy readily when he is not feeling well or is indisposed in any way, and that to accomplish anything in such a state requires an extra effort of the will that is very exhausting. It addition, at such times one is readily subject to pessimism, blues, melancholy, indecision, irritability, anger, cowardice, etc., not to speak of worse things. On the other hand, when one is feeling well, there is a sense of vigor and spirit that enables him to work at full speed on the most difficult task, and courage, optimism, joy, good will to others, possess him and his heart overflows with pleasure in simply living, and he can say, "I am glad that I am alive." Now the former state is the characteristic accompaniment of weak and flabby muscles, with their attendant train of dyspepsia, constipation, pale blood, sallow complexion, nervousness, headaches, backaches, and other aches ad infinitum. The latter state, the state of "euphoria," as Dr. G. Stanley Hall delights to call it, is always characterized by firm muscles, clear skin, rich red blood, a firm step and erect bearing. This state is the resultant of muscular activity primarily, as the first state is of the lack of it (2).

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* Numbers in parentheses refer to bibliography given at end of this article.

Let no man deceive himself. The absence of aches and pains, the possession of a good appetite and ability to sleep well, to work hard and enjoy life without physical activity is not a state that exists forever. A large inherited bank account that receives no deposits but is constantly subject to draft may stand considerable overdrawing, but some day the check returns with this cabalistic phrase across its face, *"No funds."*

These many years our books of physiology and hygiene have taught us, and our experience has corroborated them, that proper activity of the motor organs—the five hundred and odd muscles that make up at least half by weight of these bodies—is absolutely essential to that condition of fluid and tissue which renders health possible and without which health is impossible. Now if muscular activity serves no other purpose than this, there would be sufficient reason for the Association to encourage and promote its practice. In fact, this consideration has been the sole basis for the physical department of all Associations till recently, and is yet in most of them. While it may not be disputed that the securing of health is fundamental, yet there are other and higher and hence more important matters that must not fail to be provided for if this department is to measure up to the full limit of its possibilities and hence of its responsibilities.

Another phase of this physiological side of the interdependence of body and mind, and one that is not generally considered, is the relation of muscular activity to mental endurance. All mental activity, as well as physical, involves the expenditure of energy generated in nerve cells. We are more or less familiar with the fact that for a given muscle to contract, there must be a stimulus sent to it from an appropriate nerve center, and that its contraction is accompanied by a rise of temperature and an increased blood supply. It is not so commonly known that every mental action involves some physiological action, but if one will consider the sensations he experiences when thinking vigorously and note the sense of heat and pressure in the head, indicating an increased blood supply, he will experience one evidence of it. Experimental evidence on this subject is abundant. If a person in a relaxed state of body and mind be placed on a delicately balanced table especially constructed for the purpose and then be given an arithmetical problem to solve, the table will tip in the direction of the head. Delicate thermometers applied to the head show a rise of temperature during mental activity (1, pp. 46-48).

The nerve cells of which the brain is composed are microscopic bits of matter each made up of a denser central body termed the nucleus, which forms a reservoir, as it were, of energy, and a more fluid-like mass surrounding the nucleus called the cell body. Projecting from the cell are numerous fibers that serve as conductors, some for conveying impressions to the nucleus from the sense organs, others to connect it with different cells in various parts of the brain. Observations made directly upon the living cells show a gradual shrinkage of the nucleus occurring while the nerve connected with it is being stimulated. After the stimulation ceases, there is a gradual recovery of the cell to its normal condition if it has not been overworked (3). Now, different parts of the brain control different parts of the body and are concerned in different mental processes. These various parts, however, are most closely connected not only anatomically, as we have seen from the description of the brain cell, but also in their activities, as will be seen from the following. One would suppose that it would be possible to exercise in turn each group of muscles of the whole body till each was completely exhausted, but in practice it is found that after the legs, for instance, have been tired out in a hard jumping contest, it is impossible to exert the usual power with the arms. Vigorous mental action is impossible after a period of arduous muscular labor, and, conversely, physical strength is decreased after a prolonged period of vigorous mental effort. We are familiar with the greater ease with which muscular movements are performed after a few minutes warming up exercise. We know that mental excitement increases strength, as in the case of the maniac. It is also true that a short period of muscular exertion acts as a direct stimulant to mental action. From a consideration of these facts, we are led to the conclusion that when the brain is well organized and the connections between the cells are open and often used, if one cell or group of cells is called upon to furnish more energy than it can supply, it is reinforced by that from other cells which tend to discharge toward the point of least resistance—the depleted cell (4). This theory affords a ready explanation of the various phenomena just cited. It is further borne out by the fact that men whose lives are devoted exclusively to heavy manual labor during long hours and with little variation have not the power, even if they had the desire, to develop intellectual ability; and, on the other hand, the man who gives himself up exclusively to intellectual activity without exercise for the motor organs is, ere long, without either mental or physical power. For the law of the body is that normal activity of any part will stimulate its growth and development to the maximum, while abnormal activity as well as disuse will cause its atrophy and degeneration.

From all this we deduce the following: That vigorous muscular exercise during boyhood and growth will so conduce to the thorough organization and unification of the motor brain by developing strong and healthy cells with many open connections between them, that it shall become a veritable magazine of energy that in adult life will be so at the command of the individual that its whole power may be concentrated on whatever intellectual task he may enter into. We may recall instances of brilliant mentality coupled with physical weakness, but the cases of mental endurance without bodily vigor are few and far between (4,pp. 88-90; 5).

Another aspect of this power of one brain center to draft energy from another center is the effect produced by overwork. A normal activity produces a condition that stimulates a rapid repair of the energy used and does not deplete the amount needed for other necessary activities. Continuous excessive practice of an activity, however, so exhausts other centers that they are unable to perform their functions and, if kept up long, permanently injures them. This is illustrated on the one hand by the case of the average working man, whose occupation is exclusively muscular and of narrow range and simple nature. When his day's work is finished, he has little energy left for anything of a higher nature. There is, however, an insistent demand of his being for action, and as he cannot initiate it himself he has recourse either to the stimulation of liquor, low grade amusement, sexual intercourse or other dissipation, or falls back into the lethargy of stupid inaction. A very profitable line of investigation might be followed here to determine what relation this physical condition of the working man has to his absence from the Christian church. Similar results may be observed among those who devote too much time to severe athletic training. On the other hand is that large number whose occupations involve little or no muscular activity, but which are almost wholly mental. In these, when there is no reserve of energy in the motor centers, very much the same results occur as noted in the working man. The bearing that this has upon the possibility of mental and moral stamina will be more clearly seen in the discussion of the next point.

The psychological aspect. Heretofore almost all consideration of the place and value of physical training has been with reference to its physiological effects, but it is coming now to be seen that it must be considered as an absolutely indispensable and fundamental factor in the growth and development of the nervous system, the training of the senses, and the laying of a broad foundation for building the mental and moral life. These conclusions, which have been arrived at since the body and mind have begun to be studied from the standpoint of biological science, are working a revolution in general educational methods and must be given full consideration in any plan that purposes to affect conduct. The facts on which these conclusions are based seem to have little significance except as interpreted by the principles of the theory of organic evolution, and we assume that hypothesis in all that follows.

From this standpoint we find not only that the human organism is the final product of animal life, but that each human being seems in the course of development, from his conception on, to follow an order that corresponds very closely to that which appears to have been followed by the race as a whole. Beginning as a microscopic mass, not to be differentiated from the lowest permanent animal forms or from the embryo of other animals, it rapidly but distinctly, with many skips and short cuts, passes in an orderly manner through the forms that characterize the great divisions of the animal kingdom—protozoa, hydrozoa, worm, fish, reptile, early mammalian, primate, human. When born, the human is the most helpless of all animal young, and is not more human in his mental activities and some of his motor reactions than the higher apes, and it is several weeks after birth before the distinctive human characteristics begin to appear (5, p. 71; 6). His ancestral animal traits begin to disappear and he proceeds to rehearse in outline the history of the human family. By the time of birth some functions have been fully perfected, especially those of the respiratory, circulatory and other vital organs, and certain movements of the trunk, limbs and mouth. From then on the various activities develop in apparently fixed relations to each other, some beginning to appear immediately and gradually maturing, as in the movements of the hands, which by five or six have acquired only their grosser movements and have but 50% of the accuracy they will have received at sixteen, with from 10% to 20% more to be acquired after that (7, pp. 50-64); others, as sucking, come to maturity in a few hours; while still others, as the movements of the eyes, in a few weeks or months. Each of these activities has a certain period in which it begins to grow and blossom out and during which it is most susceptible to certain kinds of training. This is called its "nascent period" (5, p. 72). These nascent periods seem to fall into three general groups which are characterized by the predominance of the culmination of certain of them (7, pp. 20, 21).

The first group, covering the first two or three years of life, is marked by the development of those activities (creeping, walking, maintaining the equilibrium, and the simpler movements of the legs, arms and hands) that must become reflex in order that the mind may be free for the acquisition of higher functions. The second group is characterized by the nascencies of the higher functions of the sense organs, beginning about the second year and coming to a ripened but slow growth from the ninth to the twelfth year. For instance, the boy's interest in tools and marble games, activities involving the accurate use of the hands and fingers, begins about six or seven. The third group begins about the twelfth year and extends through adolescence. It is marked in the boy by the great physical, mental and moral crises that take place—the appearance of the sexual function, the dawning of rational thought and reason, the birth of the heart life, religious judgment (7, pp. 22, 23; 8).

It must be understood that no significance attaches to the number of groups; it is but a rough and convenient classification which serves to emphasize the fact of development by periods and stages. Moreover, there is no sharp distinction between these groups; they overlap—some of the second and even of the third group appearing in the first, some of the first not being perfected until the time of the second, and some not till the third—but the relation of the times of their appearance and culmination throughout the race is nearly constant (7, p. 21). Nor must it be thought that the limits given are fixed; they are but approximate—averages, as it were—each having a considerable range of variation. The important things to observe are, that progression is from the simple to the complex, from fundamental muscles (those of the trunk, thigh, and shoulders) to the accessory (elbow, wrist, hand, and fingers), from that which is oldest racially to that which is most recent (7, pp. 25-37).

When the nervous system is examined, it is found that before birth the individual has received a certain number of nerve cells which, while differing in different persons, remain constant in the individual throughout life. A certain proportion of these are fully developed at birth, about as many more develop up to fifteen years of age, and a tenth more by twenty-five. This probably continues in some cases till as late as forty (5, p. 71. 7, pp. 7, 8). A large proportion remain undeveloped throughout life. A less percentage, however, remain so in the case of persons of a wide range of physical and mental activities than in those of narrow lives and restricted experiences (7, p. 10). The order of the appearance of the various activities which we have noted above correspond precisely to the order in which these nerve centers develop. If, by reason of disease or other cause directly affecting it, a nerve center is unable to transmit stimuli to its appropriate organ, the activities of that organ do not appear. On the other hand, if for any reason an organ is prevented from responding to the stimulus sent to it at the time its center begins to develop, the development of such center is prevented. Children born blind or deaf have the centers connected with the eyes or ears undeveloped. The loss of a limb previous to the period of its activity results in the non-development of the corresponding centers (7, pp. 6-19).

Two of the laws deduced from these facts are: First, nerve centers are dependent for their development on use (9); and second, such use must come during the nascent period if the fullest and best development is to occur. Inversion of the order of training in the plastic years is disastrous, and delay is likely to render it altogether useless (10, 11). The practice of some of the functions has been going on during the evolution of the race for so long a period that they come to the individual fully developed, and nothing that one may do can overcome the habits thus established. This is also true in some degree of most of the functions appearing in the early years of life, and all that is necessary is to avoid interference and to provide favorable conditions of nutrition and practice (11, pp. 363, 366, 367). As Prof. Fiske says, "The mind of the child cannot be compared to a blank page, but rather to a sheet already written over here and there with invisible ink which tends to show itself as the chemistry of experience supplies the requisite conditions" (12). However, there is seen here not the working out of a scheme of predetermined fatality, but, by a wonderful provision of the all-wise Creator, the transference of the control of more and more of the vital processes to the lower reflex and automatic centers, thus leaving the energy of the individual and of the race to be devoted to the acquisition of higher and higher processes—the more and more spiritual, the less and less physical. For, as we get further from the day of birth, we find the power of evolutionary habit lessening and the possibility of education and training ever widening (7, p. 48). This is further emphasized by another anatomical fact. In the early years of life the fibers that connect the various cells that have developed are relatively few, but as life goes on it is found that these connections become more and more numerous and the number of cells that become directly associated in this way is related directly to the practice given them (7, pp. 8-11). Correlated with this is the fact that variations in intelligence are associated with variations in brain complexity (12, pp. 140, 287). This is true not only as between races, but also between individuals of the same race, and the conclusion is that it is directly related to education and training as effect to cause. Moreover, when this training is inadequate or improper at any stage, it is observed that not only that stage but all succeeding stages are affected thereby in a way that subsequent training cannot wholly repair, which leads to the conclusion that each level that is reached in human development is built upon that which precedes it and is essential to that which follows (6, pp. 424-445).

When, now, it is considered that from one-third to one-half of the brain surface where the higher centers are located has muscular functions, and the bulk of the activities of boyhood and youth are so directly motor, one may appreciate somewhat the importance of the proper training at such time of the motor organs that there may be the fullest possible brain development and its thorough organization and unification by the establishment of connections between each center and the largest possible number of other centers. Now it appears that not only is the development of the nervous structure dependent upon muscular activity, but the range of one's psychic activity is also related thereto (9, pp. 797-798). Among animals and races of men we have already noticed that range of intelligence varies with range of motor activities. One's ideas are formed from the sensations produced by his muscular experiences, and the more varied the latter, the richer the former. Idiots (13), criminals (14), and delinquents (15) are deficient in height, weight, and strength; their muscular movements are relatively few, of the simplest nature, and inaccurate. Dr. Seguin successfully treated idiot children by carefully directed physical exercise, beginning with the simpler movements of the larger fundamental muscles and gradually proceeding to those involving complex coordinations of the accessory muscles (7, p. 37). Dr. Wey, of the Elmira Reformatory, by a careful regimen of diet, bathing, and physical exercise, so completely altered the conditions and nature of a special class of stupid, immoral dullards ranging from nineteen to twenty-nine years of age that, in addition to the purely physical gains of weight and strength, "their aimless, shuffling gait gave way to a carriage inspired by elastic muscles and supple joints, their faces parted with the dull and stolid look they had in the beginning, assuming a more intelligent expression, while the eye gained a lightness and clearness that before was conspicuous by its absence. With physical training and improvement there came a mental awakening, a cerebral activity never before manifested in their prison life. The purely animal man with his ox-like characteristics seemed to recede before the intellectual . . . During the five months they were under observation, their average marking in school was 74.16%, as against 45.25% for the five months immediately preceding their course of special training." The records show that except in the case of two of this class, these gains were permanent (16).

This mental and motor sympathy is further emphasized and its relation to good morals and character further revealed, when we consider to what an extent the muscles form an essential part of the psychic apparatus (2, p. 156). As Dr. Hall says, "We think in terms of muscular action, more or less remote, and all the parts that were concerned in the original activities are more or less active in the thought. Nerve currents are constantly going to muscles and coming from sense organs, all being a part of the thinking apparatus." Hence we cannot but conclude that one's earlier neuro-muscular activities bear a direct relation to his later thinking (9, p. 797). Try an experiment for yourself. Think through any of the usual operations of making your toilet, such as tying your necktie. It will take about as long as it does to actually do it, and you will be conscious throughout of a sort of latent activity of the muscles ordinarily involved in it.

This is also true of the emotions. The muscles and vaso-motor system are essential parts of the emotive apparatus. Suppress all the muscular accompaniments of anger, for instance, the next time you think you have been wronged, and note what a pale, colorless emotion you experience. Richness of emotional life is dependent on the power to express it, and this is dependent upon muscular control. Those who have had the widest neuro-muscular experiences have the richest and sanest emotional experiences (10, ch. 25). Volition, which with thinking and feeling make up our states of consciousness, expresses itself in motor activity. "Flabby muscles and weak will, if not related as cause and effect, are at all events concomitant effects of a common cause,—a lack of motor efficiency in the brain" (2, p. 155; 5, p. 74; 6, p. 434).

That there are many exceptions to the matters here stated is true, and each of you can doubtless call to mind some. It is, however, not practicable at this time to enter into a discussion of such; and if it were, it would not be possible satisfactorily to explain them, as a full knowledge of all the facts necessary to such an explanation is not at present available. However, these would not in any wise invalidate the truth of the general proposition; for that the evidence adduced is sufficient.

Let us now consider the *sociological aspect* of our subject. It is to Dr. Gulick we must give the credit for making the contribution that has done most to increase our knowledge on this point and make possible its practical application. I quote here freely from his monograph (17).

When the voluntary activities of boys are observed from the first to about the sixth or seventh year of life, it is noted that their manifold activities of kicking, whole arm and body and hand movements, picking up and dropping things, block and sand plays, running, throwing, cutting, swinging, etc., are progressive as to complexity and strength, are those which must become reflex before the higher achievements of later life are possible, and that they are individualistic and absorb all his time and attention. In later years activities of this kind continue, but demand a constantly decreasing degree of time and interest, as seen in the use of tools, sailing, rowing, swimming, gymnastics, etc.

Beginning approximately about seven, there is seen a shading off from this group and a gradual but rapid increase of interest and time and attention given to tag games of all kinds, certain kinds of ball games, marble games, and the like. We see here an entirely new element entering in,—the social. There is the gradual change from the predominance of activities whose center is exclusively one's self to an all absorbing group whose chief center of interest is one's self in relation to others. These introduce the consideration of the element of competition, formal rules by which one must abide, consideration of others, the beginning of ethics and morality. The period of predominance of activities of this nature comes gradually to an end about twelve. Games and sports of this character continue, however, but with a decreasing emphasis, as seen in track and field sports, hunting, fishing, wrestling, boxing, fencing, billiards, bowling, golf, etc.

Continuing now into the teens, we find another marked change taking place and the activities commanding the greatest interest of the boys are baseball, basketball, football, gangs, camping, houses in the woods, pals, hero service. These activities are almost universally carried on in groups or gangs. They are the characteristic games of the Anglo-Saxon youth and of those of Anglo-Saxon tradition or environment. Other nations do not have them, or only in a rudimentary degree. Hero worship is now at its height and is a prominent factor in all the games of the period. There is now demanded much greater strength and skill than at any previous time, endurance of pain and discomfort often in a marked degree, cooperation with others for the achievement of a common aim, subordination of self to a leader. At this time team work is the dominant idea, as was individual excellence in the preceding period. That the mental and moral qualities demanded by such activities are higher than any yet required is readily noted. Here is the beginning of self-sacrifice, altruism, the giving of one's self for others. That these are the fundamental factors in the Christian life we well know, and they are a measure of the individual's capacity for Christlikeness. The boy that passes from the previous period on into adult life without experiencing the activities of this, retains the characteristics of the former period and seldom becomes a citizen interested in anything but his own profit. You all are familiar with the "star" player, one in whom the tendencies of the previous period have persisted.

Now, the time of the appearance of interest in any activity is usually a safe index as to the proper period for its practice and development. Moreover, the intensity of the interest is, I believe, a measure of the value of such an activity to development of the body and mind; otherwise, it has no significance, and that is unthinkable. Such interest always leads to action of some kind which always establishes a habit that persists when the interest in the original tendency passes away. If, therefore, we would secure a habit that will make for righteousness, we must adapt to present conditions that practice which in the course of evolution has been the means of ingraining such a tendency in the fiber of the race, correlating with it the principles of the higher life till a habit of thought and action is established that will effectually prevent a retrogression to lower standards of conduct or the establishment of a habit that may nullify the normal influences of a later period (10). Beginning, then, with these characteristic adolescent activities in small groups under full control, there may be established ideas of relationship to others of the group that later may be extended to the persons in other groups of the same organization. On this may be built a loyalty to the largest group which, extending out to still other groups with which it may come into relationship, shall not only widen the interest and sympathy of the individual, but also be the means of promoting the principles of the group itself, and thus, if it be the Young Men's Christian Association, of extending the Kingdom of God in the community. By this we will largely determine the character of the individual's later relationship to his party, his city, state, nation, and race. The training of the leaders of such groups is not the least important of the results of their activities.

Conceding all this, you may now be impelled to ask, "Are not the activities which the individual performs in the ordinary course of his daily life sufficient to produce these results; and if so, why should the Young Men's Christian Association make special provision for them?" That the routine of daily life is not sufficient for the purpose can be easily shown.

In 1800 less than 4% of the population of the United States lived in towns of 8,000 or more inhabitants. At this time nearly one-half of the population of the Northern States so live, and for the nation at large the proportion is over one-third. What this means in the matter of light, air, noise, dust, water, and vegetation can be appreciated without further word by any one who has lived in both city and country. A century ago the bulk of the people lived on farms, where the variety of hand occupations was sufficient to maintain health and strength and to supply energy to the brain. In those days the shoemaker performed all the manifold operations involved in the building of a pair of footgear. In this day of automatic machinery and power tools, a pair of shoes will pass through the hands of a hundred workmen, each of whom expends but a minute fraction of energy in the operation. So with almost all manufacturing, steam has taken the place of muscle. With these new occupations has developed a long list of special diseases. Then transportation was by foot or horseback, now by steam or electricity. Communication was slow and infrequent and business transactions were done leisurely and at little expense of energy; now the telephone, telegraph, phonograph, typewriter, and press make communication rapid and easy, so that the things to which a man must attend in a day are without number. For children there has been a lengthening of the school day, an increase in the number of days per year, and an actual enlargement of the per cent. of the whole population who attend school (18). From these facts we gather that there has been a tremendous and relatively sudden change in the activities of the nation. There has been in all classes of the population a radical change from a combination of muscular and physical activity which was for the mass of people predominantly physical but of a nature that furthered the psychic functions, to a combination that is either predominantly psychic at the expense of the physical, or is of a monotonous physical character that contributes nothing to the psychic apparatus.

Where now is the hope of the multitude of boys and young men whose motor training is so entirely neglected in their school experience, who come to twelve or fourteen with no muscular experience except such as they received in the irregular, uncontrolled, police-supervised games in the nature-like environment of the gravel or brick covered apology of an average school playground, or the granite turf of a city street? That wonderful results can be accomplished in the attempt to repair this deficiency, we know from the work of Drs. Seguin and Wey previously referred to.

In the modern, up-to-date Association the individual should receive for himself such training as may be possible in the stage of development he is in. The business man past the age of growth and development should receive renewal of health and energy; the young man, a considerable proportion of the education he missed in boyhood, correction of gait and posture, health, strength, endurance, power; the adolescent boy just coming into the bloom of youth, sensory training he may have missed, development of bodily structure, unification and organization of the brain, energy, the foundation of mental and moral control, socialization. He should be taught that as he takes his place as a citizen, he should bend his efforts to make possible to the generation just behind him the things which he has missed. Above all, he should be taught that he should not live to himself. He is an integral part of the race; it is his privilege to pass on the divine spark, it is his opportunity and his duty to cause it to burn with increased brightness in those whose fortune it shall be to continue his line. Thus he shall serve his Maker and his race.

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THE MUSCULAR ACTIVITIES RENDERED NECESSARY BY MAN'S EARLY ENVIRONMENT.

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The muscular activities that the human organism most needs for its health and growth are those which are in line with racial evolution. For, the individual is born out of the life of the race; the structures of his body are the product of what the race has been; and his training for the future can be intelligently provided for only by taking into account what the race is becoming. A preliminary problem, therefore, in physical culture, as in other branches of education, is to form some sort of estimate of the trend of human evolution.

Now, one way of determining the trend of evolution in the human organism is to study the fundamental activities which that organism has performed. This is merely to do what scientists are now everywhere doing in their studies of the various forms of life. It is coming to be seen that the structures of an organism are determined by the functions which they discharge. Man's muscular system offers no exception to this biological law. It has been built up through its own activities. By studying the nature and trend of those activities, we are therefore in a fair way to discover the nature and trend of the evolution of muscular structures.

Broadly speaking, there are four great groups of activities which have everywhere been evolved by men's needs, and which, in turn, have reacted upon their lives and progressively modified them. These are: (1) the activities that center in getting food, shelter, and clothing; (2) the activities that center in the relation of the sexes and the rearing of children; (3) the activities that center in war and government; and (4) the activities that center in religion, education, art, amusements, etc. These groups of activities may be called, respectively, *Industrial, Affectional, Protective,* and *Cultural.* All of them have been indispensable to the development of racial life as a whole, but each has contributed more or less directly to some particular end. This fact determines their absolute and relative importance in the scale of values when we come to estimate them from an educational point of view.

What activities, then, have been chiefly effective in building up the muscular system? Manifestly, the industrial activities, those springing from the fundamental needs of life. All the others, however important in other respects, are subsidiary in this. Thus, most of the affectional activities that modify muscular structures have had to do with the care of children. In all the lower stages of civilization, these have mainly been performed by women. The same is measurably true even of the higher stages of civilization. Hence but half the human race has been directly modified by them. Other affectional activities, such as those leading up to a union of the sexes, are not sufficiently prolonged or constant to have had much influence in muscular development. Their influence has been mainly exerted in developing the reproductive and nervous systems. The protective activities have likewise had a subordinate place in the shaping of muscular structures. None of these, with the exception of fighting, has probably had any appreciable influence. The importance of fighting itself, in the evolution of the species, has been greatly exaggerated. The fact is that combat with enemies is always incidental to other and more fundamental activities. The natural state of animals and men is not war, but peace. Half the human race, all the time, and the whole of it, much of the time, have been workers and not warriors. In general, the longest lived and the most stable groups of animals and men have been those that fought the least. In the struggle for existence, the relatively peaceful herbivora have in the past outnumbered, and will in the future outlast, the fighting carnivora. The industrial Chinese nation has survived for untold centuries, while the military nations of the earth have come and gone. War, therefore, whether between individuals or groups, cannot have developed the more fundamental structures of the human organism. It can only have given rise to secondary structures, such as are analogous to the horns and claws of fighting animals, and, like them, unstable and changing from generation to generation. Finally, the cultural activities have affected but little the development of the muscular system. Aside from religion, culture is a recent thing in the experience of mankind. So far as it contributes anything to muscular development, therefore, its contribution belongs to the future. But, in the nature of things, its influence in this regard must remain comparatively slight. Its chief organic effects are to be found in modifications of the nervous system.

On the other hand, when we consider the activities that have sprung from the need of food, shelter, and clothing, we discover an influence everywhere and always powerful. It has been estimated by some anthropologists that man has lived upon the earth upwards of 500,000 years. During all this time the struggle to get something to eat and to secure protection from the elements has been unceasing. Love, war, and culture have been intermittent, changing with the periods of individual and racial life. Hunger has known no change. In the struggle to satisfy it, activities the most intense and varied have been performed. Before the invention of tools, men picked fruits and nuts, gathered roots and herbs, and dwelt in caves or under canopies of trees. Yet even in such primitive activities, the muscles of the limbs and trunk were being shaped towards their present form through maintaining an erect position, walking, running, leaping, climbing. Then tools were invented, and henceforth men were modified more rapidly through the influence not only of their natural environment, but also through the artificial environment supplied by the tools themselves. They became hunters, fishermen, domesticators of animals, agriculturists, mechanics, manufacturers, engineers, navigators, and tradesmen. They invented fire and cooking, pottery and basketry, spinning and weaving, dwelling houses, boats, wheeled vehicles, and railroads.

The influence of all these industrial activities is immeasurably the greatest that has been brought to bear upon man's organic life. It is a conservative estimate to say that three-fourths of the physical energy of mankind has gone into these activities. Even in current civilization, where we are apt to think the labors of the muscle are becoming relatively less important, the law is not otherwise. According to the United States census, from 60% to 85% of the gross income of our population goes out for food, clothing, rent, fuel and lighting. Of the 22,735,661 men and women reported by the census of 1890 to be in gainful occupations, 8,466,251, or over 37%, were working on farms to provide the raw materials for food and clothing; 4,712,622 persons, or 20%, were working in factories to prepare these raw materials for use; and 546,950 persons, or 2½%, were working in mines, lumber camps, and quarries. That is to say, over 60% of the people of the United States who work at all are engaged in occupations that entail severe and prolonged muscular exertion. Add to this the number that are engaged in lighter manual work, such as household servants, etc., and the proportion is easily swelled to 75%. It is obvious, therefore, where the muscular energy of civilization is being expended. It is obvious where this same energy is being multiplied. It is likewise obvious where the muscular resources of the race in the future, as in the past, are being provided for.

The relation between industrial activities and the evolution of muscular structures thus indicated by a survey of the normal course of human development, has still further confirmation in abnormal phenomena. Thus wherever industrial activities have been unduly subordinated to others, there degeneration of nations, families, or individuals has appeared. Peoples living in tropical countries, freed from industrial struggles, have invariably been arrested in their development. Nations whose upper classes have given themselves over to the activities of love, war, or amusement have decayed and been subjugated by the hard-muscled nations of workers. Families and individuals who have cut themselves off from industrial activities have lost their vigor of body and brain and have been eliminated from the human struggle for survival. There is no more potent factor of degeneration in current urban life than the increasing emancipation of the upper and middle classes from the necessity of working with their hands. The result is flabby muscles, flabby brains, irresolute wills, emotional ennui and intellectual dilettantism. Artificial gymnastics, whereby they attempt to coax nature into giving them the energy and health they are too apathetic and proud to work for, will not save them. Golf and other genteel sports that favor correct posing and fetching costumes will not save them. Nothing can ever restore this lost muscular energy and the correlated physical and psychical powers but the abandoned activities of the farm, workshop, and kitchen. Nor is this biological degeneration of nations, families, and individuals hard to understand. Whenever they stop doing the things upon which their muscular development depends, that development ceases. The biological law of disuse and arrested function begins to operate. Their muscles atrophy; the motor coordinations that long ages of industrial struggle have established begin to break up; the brain-areas that have innervated the complex movements of the organism cease to get their supply of blood and become feeble; the instincts, no longer able to find a normal mode of expression, become perverted; the emotional and intellectual tone is lowered; and the total result is the gradual extinction of the nation, family, or individual.

It seems to me, therefore, a fair conclusion that the nature and trend of muscular evolution have been largely determined by industrial activities. Moreover, within the period of civilized history, these activities have mainly centered in the agricultural and mechanical arts. The muscular system of an individual in a civilization like our own may therefore be expected to have just that type of structures and coördinations which adapt it to these arts. Furthermore, the instincts which are correlative with such muscular aptitudes may be expected to go out toward agricultural and mechanical pursuits. It is not surprising, therefore, that young children are naturally cultivators of the soil, builders of houses, manufacturers of clothing, domesticators of animals, and tool-users generally. Nor can it be doubted that, if such children were not diverted from these activities through imitation of their elders or by forced compliance with artificial requirements, they would play at these occupations until they had won the heritage of muscular energy and skill bequeathed by their ancestors.

If this be true, any system of physical education that conforms itself to biological laws must, while being liberal to other forms of exercise, be based essentially upon industrial activities. That is to say, it must make use of exercises that call into function the muscles and coordinations of muscles that are employed in ordinary manual work. This standard of physical education would eliminate from the problem all those exercises that are devised with reference to special muscles or feats of skill. Within certain limits, such exercises may correct deformities, and, in the case of normal muscles, they may give more or less random benefits. But they are none the less artificial in that they do not take into account the primary functions of the muscular system. As formative agencies, they are on the same level as the means of intellectual training chosen on the basis of a faculty psychology. As agencies of reformation, they resemble the specifics that medical science once so extensively employed when it treated symptoms rather than causes.

If not artificial exercises in physical education, what then? The natural exercises involved in play and work,—play such as I have already pointed out that children spontaneously engage in; work such as makes an adult man or woman a participator in the industrial activities upon which civilization rests, and in the health, energy and resourcefulness that are associated therewith. Without excluding absolutely the play-activities that are not industrial, it is my conviction that all others contribute so little to healthy muscular development, and involve so many risks of arrested growth and perversion, as to be of doubtful value. If what I have tried to say with regard to the trend of muscular evolution is true, the disposition to single out such activities as competitive sports and the dance and erect them into a system of physical culture is, in the highest degree, unscientific. Competitive sports belong to what I have called protective activities, biologically considered. They are predominantly neuro-psychical rather than muscular. That is to say, nervous and emotional excitement plays a much larger role in such sports than does intelligent motor control. The latter is not absent, to be sure, but it is subordinate. The tendency is always toward muscular excess, the breaking up of fundamental motor coordinations, and the setting up of nervous and emotional tendencies that are harmful. This explains why it is that professional athleticism is seldom associated with symmetrical organic development, and that competitive sports are usually so hard to control among adolescents. The dance belongs to the group of affectional activities.

Its influence is primarily upon the reproductive system, the nervous system, and the emotions. As in the case of competitive sports, the tendency here is to stimulate, through nervous excitation, a precocious and hypertrophied development of organs and functions that racial evolution has uniformly subordinated to special periods and to special ends. On the other hand, industrial play-activities, whose influence upon the nervous system and the emotions is less stimulating, secure a maximum amount of healthy physical exercise with a minimum amount of risk.

If you ask where a type of industrial play-activities may be found that will provide most economically the exercise that racial evolution demands, I point you to the plays of children in the average American farm community. There each child plays spontaneously at the things which have won for humanity its heritage of muscle and brain. It plays at inventing tools; at farming and gardening; at manufacturing clothing; at building houses; at domesticating animals; at the various household arts. In short, it plays at all the typical activities that have developed the organic life of man. In doing so, every muscle gets just the kind and amount of exercise necessary to develop it, and the child comes to maturity not as an athlete with especially developed muscles, but as a symmetrical man or woman whose muscles are firm and obedient to the will, who can endure hardship and disease, and who can fill his place in the economy of a world whose fundamental and inflexible law is that of work. There is no system of physical education as such in a farm community. The conditions are the simplest,—healthy instincts and favorable environments. Nature is the only teacher. Yet who will deny that out of such communities come the very best examples of muscular development that civilization produces?

Now, it may seem absurd to suggest that here is where physical education in city communities must find its models. Yet, it seems to me, biological science points clearly to just this necessity. These models may have to be adapted somewhat to the conditions of city life, and the conditions of city life may have to be adapted to them. But, in any case, to the type of play-activities here represented, educators will some time go. We are becoming accustomed to consult nature in so many things now-a-days, that very soon we shall consult her about this matter of building up muscular structures that shall meet her approval. And when we do, she will surely direct us to the place where, of all others, she is most effectively working out her own ideals.

SCHOOL HYGIENE.

MAXIMILIAN P. E. GROSZMANN, PD.D.

This article is not to be devoted to the discussion of diseases and abnormal conditions, but rather of prophylactic hygienic measures. But attention should be called to the following points:

First: There ought to be connected organically with every school a school physician, for the purpose not only of supervising the children so as to control the spread of contagious diseases, but also of giving general hygienic advice and direction, of assisting in the discovery of defectives of all kinds, and of being the teacher's assistant in every case where physical and mental abnormality require a comprehensive diagnosis.

Perhaps the first institution where regular medical inspections and examinations were provided for was the Workingman's School (later enlarged into the system of Ethical Culture Schools) of New York, under the direction of the author. This dates back to the year 1891. Since that time a number of city systems, notably New York and Chicago, have appointed a regular staff of physicians, and their functions are becoming more and more clearly defined and organized. Everywhere the physicians have soon found opportunity for demonstrating the paramount necessity for the work for which they have been detailed. In almost every instance of investigation, appalling conditions were discovered to exist, especially with regard to the exposure of the pupils to the spread of contagious diseases.

Second: Every teacher, and especially every school principal, should have training in the ready recognition of the ordinary symptoms of the common children's diseases and of other physical danger signals.

Third: There must be a strictly enforced system of regulating the attendance in the case of infectious and contagious disease.*

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* A very complete statement of scarlet fever, one of the worst diseases that can befall any child, has been published by the Michigan State Board of Health. It has been in part reproduced in the Child Study Monthly of December, 1899.

Fourth: All abnormal children, including nervous children, stammerers and others with suggestive habits, should be removed from the ordinary school and taught in special classes or institutions.

This article is especially concerned in such hygienic suggestions as will tend to make the school conditions normal for generally normal children.

First in importance here is the location and equipment of the schoolhouse as such. There must be selected a location affording an abundance of light and air, freedom from obnoxious noises and odors, inspiring and helpful views across the surrounding country, etc., etc. In a large city these conditions cannot always be fulfilled, and compromises more or less fraught with danger must be resorted to. Then there should be fireproof construction, convenient stairways and elevators, airy basements, perfect sanitary arrangements. All these are largely architectural problems and need not be elaborated here. Suffice it to say that care must be taken to have the schoolhouse surrounded by ample and shaded playgrounds, with trees and shrubbery and flower beds, to afford outdoor recreation and exercise. Gymnastic apparatus for outdoor practice, and school gardens proper, ought to be provided; and there ought also to be convenient places for kindergarten and primary work in the open air. Sand heaps, croquet, tennis, and other equipments for plays and games are valuable accessories.

One point, however, ought to be emphasized. The modern tendency to erect large central school buildings with many stories should be decidedly discouraged. The assembling of great numbers of pupils in one building increases the danger of exposure in case of contagious diseases. But the main objection to tall buildings is the stairways. There has been established a very distinct relation between heart disease and tall schoolhouses, and the climbing of stairs has often a very injurious effect upon pubescent girls. Smaller schoolhouses are therefore preferable.

But the room, or rooms, in which the child spends so many of his waking hours, demands our particular attention. The first warning must be against overcrowding. In some schools, especially in large cities, this overcrowding assumes criminal proportions. Not to speak of the impossibility of individualizing instruction and discipline in an overcrowded room, the presence of too many children in one room vitiates the air, promotes disease, and produces generally unhygienic conditions. Thirty pupils—under especially favorable circumstances, forty—to a teacher should be the extreme. If there could be groups of twenty, it would be better. Where there are more than twenty-five in a room, the teacher ought to have an assistant.

The first requirement of a proper schoolroom is a sufficient amount of light and air space. The figures determining these factors can be found in any handbook on school hygiene. Ventilation, e. g., arrangements for drawing off the vitiated air and for supplying the room with a constant current of breathable, pure air, is even more important than an exact allowance of air space. Proper ventilation without producing draft is a matter of engineering science. It is usually, and causally, connected with the maintenance of the proper temperature in the schoolroom. There is as yet hardly a system of heating invented which gives an even temperature all over the room; usually those children who sit nearest to the heating apparatus (be it stove, register, or radiator) are boiled and driven frantic, while those who sit at a distance are chilled through and through on cold days. School life in winter is full of dangers; overheated rooms weaken the power of resistance to the effect of cold weather, and cold rooms lay the foundation for colds and bronchial troubles, digestive disturbances, and the like. Yet we should remember that children, whose respiratory functions are more rapidly operative than ours, and who are moving about more energetically than we do, need less heat than adults. The temperature to be maintained has been fixed by the Buffalo Board of School Examiners in its seventh annual report as follows: In classrooms, with thermometer in center of room, 68° F.; with thermometer on unexposed wall, 70° F. In halls, 62° F. *Observe and rely upon thermometers—do not rely upon personal feelings.*

It should be observed that care must be taken not to have the air in classrooms too dry; there must be the proper degree of humidity. Sometimes in bad weather there is too much of it, not only because of the general dampness of the atmosphere, but because the wet clothes of the children add a large share by evaporation in the warm room. Children should be made to take off wet shoes and stockings on coming to school; they should be instructed to bring extra garments and shoes to school on wet days, so that they may change their wet raiment for dry. It is needless to repeat here that it is perniciously dangerous to children, or to grown people, to sit for hours in damp garments. Provision should be made to have a place in school where damp shoes, stockings, and other clothes can be dried. All wardrobes and cloak rooms should be ventilated with particular care. But we may even go a step farther.

"Experience teaches," says Wm. Paul Gerhard in an article on School Baths,* "that the air of schoolrooms is badly contaminated by the emanations from the children's bodies and by the odor from their clothing. All attempts to improve the sanitary condition of schools will fail to accomplish their object thoroughly if means are not provided to cleanse the bodies of the children. Cleanliness of school children will make the ventilation of the schoolrooms an easier problem, and, further than that, it will tend to increase the appreciation of cleanliness in the lower classes and thus indirectly stimulate bodily—and often moral—purity in the home circle."

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* School Journal, June 15, 1895.

School washrooms with ample capacity to accommodate all the children with satisfactory promptness, and school baths with shower baths, tubs, and swimming tanks, will in time be common institutions in all schools. They have been widely introduced in many places, notably in France and Germany. They afford not only opportunities for cleansing, but also for healthful stimulation and exercise.* But cleansing the bodies, where that is needed, does not suffice. The clothes of many children are sources of danger as well, apart from the disgusting odor that often emanates from them. Many change their underclothing but seldom, and their upper garments are worn, uncleaned and unaired, for long periods at a time, gathering dust and microbes and issuing the stuffy smell characteristic of neglected homes. As long as we cannot change these homes, it is a simple matter of self-protection to provide means in school for the proper cleansing of the children's garments, eventually even for furnishing them with temporary substitutes. But possibly the cleaning process of both persons and garments could go on simultaneously. Dr. Alfred Carpenter, of Croydon, England, in his book on "Preventive Medicine in Relation to Health" (1877), makes this suggestion: "Every public elementary school ought to have a proper washing place, so that the children might wash the whole of their body at least twice a week, as well as their hands and face. There should also be a washing place for clothes, with a drying closet attached which could dry the clothes as quickly as possible and be so arranged that clothes might be cleansed and disinfected, as well as linen clothes washed."

There is further the adequate cleaning and disinfecting of the schoolrooms themselves, as well as of the utensils and materials employed in the daily work of the school. One of the first counsels in this regard would be: Keep the dust out as far as possible,—not only by preventing the children (by proper arrangements for cleaning, brushing, and scraping) from carrying dirt and dust into the building on their shoes and in their clothing, but also by avoiding within the four walls of the building and the room all those things and practices which would cause, stir up, and re-distribute dust. Mark: every cubic centimeter of air in an ordinary room within the confines of a city contains 400,000 particles of dust. How many there may be in an ordinary schoolroom I do not know. Not only is there an ever-present danger from the admixture of micro-organisms, but these enormous clouds of dust clog our respiratory organs and stop up the pores of our skin. Use, then, as dustless a crayon as you can purchase in the market, and wash your blackboards with a wet sponge or rag instead of using those vicious erasers. Throw your sponge away after use, for few things are more effective as germ breeders than sponges and brooms. Wash your rags once a day, and do it well. Moist cloth, dipped in a solution of corrosive sublimate (bichlorate of mercury, 1:3000, for infection), should be used daily for the cleansing of seats and desks, etc. Employ moist sawdust for sweeping the floors. Burn up all dusters and other hellish devices for raising and distributing dust under the pretense of cleaning. The windows should be washed once a week to secure the full benefit of the light supply for which they are intended; and the walls need frequent cleansing and ought to be recalsomined annually, as this process also secures excellent disinfection. All schoolroom decoration should therefore be simple and inexpensive, so that it can be removed and renovated without undue expenditure and chagrin.

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* A special article might be written on cleanliness of hands and fingers, particularly of the finger-nails; they are hot-beds of bacteria.

Attention must further be called to the dangers lurking in apparently innocent utensils and materials. Slates, apart from their bad effect on vision and handwriting, harbor countless colonies of microbes and bacilli. Soap and towels, when used in common by children; likewise common drinking cups; pencils which are kept in common receptacles and exchanged; even the bits of chalk which wander from hand to hand, are carriers of infection. The same may be asserted of the books that are not individual property. Clay, especially when kept moist and used over and over again too long, is particularly dangerous. Children should wash their hands carefully (with soap and some disinfectant) before and after using clay; in fact, by insisting upon scrupulous cleanliness of hands and face, much of the danger here referred to may be obviated. Still better would it be if a suitable system of disinfection at regular intervals would be inaugurated to supplement the measures for daily cleansing. In times of epidemics of any kind, even the seemingly most trivial, such disinfection should be undertaken daily after school hours. The newly offered formaldehyde (formic aldehyde, CH_2O), a gaseous body formed from methyl alcohol by oxidation, is a very effective and easily applied disinfectant which will even cleanse the utensils contained in the schoolroom in a satisfactory manner.* It requires no special mention that all sanitary appliances, washbasins, and the like, must be kept absolutely clean and disinfected.

One of the most effective destroyers of disease germs is sunlight. Abundance of light—pure, diffuse light—in all parts of the room is a prëeminent requirement of schoolroom hygiene. As there is such an enormous difference between sunlight and artificial light, even if each desk were provided with a special lamp, care should be taken to preserve the eyesight of growing boys and girls by having them work as much as feasible in daylight, and to warn them against the peril of working and reading under insufficient illumination. Let the light supply, be it repeated, always be plentiful, and available even in the farthest corner of the room. "The pupils sitting farthest from the window naturally adopt the habit of holding the books nearer to their eyes when the light is dim, and in this way become nearsighted, and, through sympathy with the strain upon the eyes in study, the stomach becomes disordered. Nervous dyspepsia and headaches abroad in the community owe their origin to some extent to this defect in school building."† To bring about a proper distribution of light, avoiding unpleasant and blinding reflection and glare, attention must be paid to the use of proper window shades, the tinting and finishing of walls and ceiling, the matter of blackboards (which would be more profitably greenboards), etc. The infalling natural light is, of course, greatly modified by the color of the room. Too much blackboard of the ordinary sort causes a great loss of light by absorption. Although there is some difference of opinion as to the best colors for wall decoration, it seems that the red end of the spectrum is less desirable for rooms in which fine work is demanded, as it absorbs too much of the infalling light. The lighter and more delicate shades of yellow and gray are recommended; a light buff tint of dull character is also good. The wood work should receive a coat of light paint harmonious with the rest.

The effect of a school room should be pleasing, bright, invigorating, inspiring. Tasteful combinations of color and decorative motives of a simple, restful kind; flowers on the window sills; greens and pictures on the walls and doors; here and there a bit of suggestive statuary; specimens and collections of interest and value; and, all-pervading, a home-like atmosphere,—these will make the room a positive power for good to pupils, and to the teacher as well. For what contributes to the healthy and inspiring influences of the place where we spend our working hours affects not only our physical, but also our mental and moral status.

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* "It has been demonstrated that the germs of consumption are destroyed by formaldehyde gas, and it has long been known to scientists that if some method could be found of bringing this gas into contact with the lungs, it would at once kill the bacilli." Such a method seems to have been recently discovered. Cf. Literary Digest, May 12, 1900. In this connection it is valuable to know that formaldehyde is a reliable destroyer of these germs as they may be found in the air of schoolrooms, or clinging to utensils of all kinds.

† Wm. T. Harris, "Preliminary Report on School Hygiene," Educational Review, June, 1899.

Speaking of the requirements for keeping the visual capacity of our children, as well as their nervous energy in general, intact, reference may be made to the hygiene of reading and writing, and fine work in general. "The implements we employ in our "daily tasks," says O'Shea, "are responsible for much useless drain upon the nervous system,—such apparently simple and harmless things as writing pens, pencils, and the like. Coordination of the peripheral muscles involves a relatively larger expenditure of energy than coarser, less delicately adjusted movements. Thus, fine needle work is more fatiguing to most women than washing dishes, and 'getting pigs out of clover' is a much greater strain on any man than playing golf or croquet." Let us be reminded of the proper size and body of type, length of line, size of page, etc. Glazed paper to read from is much more injurious than dull paper, and the white sheet should be replaced by the tinted page, preferably of a dull, yellowish-gray color.

A source of much functional disturbance in school is the improper posture of children in standing, marching, sitting, largely caused by too much confinement to the unhygienic and non-adjustable seats and desks of the ordinary school. Nosebleed is a not infrequent result of leaning forward in the seat to bend over a book. Dr. R. Tait McKenzie reports* on a series of examinations, made some time ago in the Montreal High School, of boys varying in age from thirteen to eighteen and averaging a little over fifteen years. He was struck by the number that presented some marked irregularity of growth, and on tabulating them he found that 20% had a marked lowering of the right shoulder, 3% had the left low, scoliosis was found in 2%, lordosis marked in 5%, and round shoulders in 3%, while the habitual standing position of 30% approached more or less closely to what Bernard Roth has aptly named the "gorilla type,"—abdomen protruded, chest flat, and head shoved forward. He also speaks of a form of scoliosis produced by fatigue. This latter point is significant, for improper seating—apart from its direct effect upon the growth of the bodily structure—causes an enormous mental tension of which few are fully aware. "People who do not habitually stand or sit in such a manner that the body is poised, as it were, and at rest, will certainly suffer for their error in lessening efficiency in both physical and mental work. The attention of the student is called to the importance of the matter of right seating in the hope that he will try to arrange his chair and desk so as to save nervous wear and tear to the fullest possible extent. . . . The matter of seating is of consequence not simply from the point of view of saving energy, but it has an important influence also upon the generation of force. A student leaning over his desk, with his lungs constricted and the arteries leading to the head compressed, is in a good way to foster mind wandering and napping. The organism then becomes clogged, as it were; it does not receive its due of oxygen, as a result of which the brain must certainly be seriously handicapped."*

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* "Influence of School Life on Curvature of the Spine," American Physical Education Review, December, 1898.

Nervous tension, however, is produced in many other ways. There is need of a proper recognition of the hygiene of instruction. A rational, elastic course of study following the natural lines of growth is the first requisite for wholesome work. To meet individual differences, there should be a certain elasticity of requirements and the possibility of instantaneous adjustment whenever a child, or group of children, evinces signs of fatigue or strain. The question of recesses deserves attention. Some teachers have injudiciously suggested a one-session plan under high pressure, with no recesses, or very brief respites only, so as to get home early in the afternoon. Such a plan is utterly objectionable. Concentrated attention and intense effort during very few brief periods is all a child, even of adolescent age, can afford; and breaks—that is, shorter and longer recesses—between these periods of work are indispensable. It has been convincingly demonstrated that a long noon recess, with ample time for lunch and rest and outdoor exercise, improves the quality of the work all around.

And then, we ought not to be stingy in the matter of holidays and vacations. Far from losing time, we gain time by timely intermissions. While our long summer vacation is probably an evil, there should be shorter and longer vacations spread over the year to come at proper stages,—at the beginning of spring, at midsummer, at harvest time, and at the winter solstice. Instead of suspending operations altogether in summer, a change of occupations, a transplanting of the school into the country where this is feasible, concentration on outdoor work, horticulture, agriculture, nature study and geography, manual occupations, art sketching, physical exercise, and the like, will be found advisable. The vacation schools conducted during the last few years in New York, Chicago, and other places have demonstrated the wisdom of such a course beyond the shadow of a doubt.

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* Prof. O'Shea, "The Conservation of Mental Energy," Journal of Pedagogy.

Our ordinary methods of school instruction imply a great degree of overstimulation, while the nagging methods of discipline produce a large amount of worry and tension in the minds of our pupils. As sunshine is the most powerful agent in destroying the germs of bodily disease, cheerfulness is the best guarantee for a normal condition of the mental and moral organism. "All healthy activity is joyous in all creatures. Instinctive joy, indeed, seems a necessary condition of all real growth, and its suppression is a grievous mistake, both mental and physical. No child can be truly and healthily developed without gladness any more than a plant without sunshine—so both physiologists and educationists tell us. As one says, 'Under the rule of cheerfulness, the intellectual faculties attain a quicker and more vigorous growth. With a cheerful spirit we think and judge more acutely and accurately. Children bring cheerfulness and mirth as a natural gift into school, provided these have not already been suppressed by an unnatural education. At school such dispositions ought to be cultivated and encouraged'."*

But having provided healthy conditions and stimuli as far as our own foresight will avail, there must be conditions in the children enabling them to respond in a normal manner. As to these,—referring, for example, to the proper amount of sleep and nourishment, to hygienic clothing, proper care of the body, and the like,—the teacher may be supposed to have little influence and responsibility. And yet, as to his responsibility, since teachers are the only ones professionally trained for educational functions, we may justly expect them to do their share toward bringing about healthier conditions even of home life than are generally found. Through visits to the homes, through parents' meetings, mothers' clubs, the cooperation of the press, much can be accomplished. Yet there are direct measures which will reflect themselves in the homes. In the first part of this article some of these have been enumerated. As to securing for the children the necessary amount of rest, let us be cautious and reasonable in the matter of home work.* In order to bring about a more rational style of dress for children of both sexes, where there is less of show and more of hygiene, let us insist upon proper habiliment in the gymnasium and on the open air playground. The Russian government has recently, by a special ukase, proclaimed that school girls are henceforth forbidden, under penalty, to wear corsets. Such an opportunity is not ours, but we can do much toward fighting this pernicious "garment" by introducing a rational gymnasium gown and by encouraging healthy sports generally. The school physicians, with their measurements and examinations, will effectively come to our aid in this matter.†

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* Educational Foundations. November, 1894.

A very important factor for normal mental and moral functioning on the part of the children, not to speak of physical growth, is proper nourishment. Here much neglect has been recorded. Thousands of children, even from good homes, come to school without sufficient breakfast, and hundreds of thousands have to be content with a cold lunch at noon. Louise E. Hogan, in her article on "Diet for School Children," makes these suggestions: "The custom of sending children to school upon a light breakfast, or none at all, with a cold lunch for the noon meal, is reprehensible to the last degree. Or, if a hot dinner is provided, the habit of rushing home at noon in a limited time to consume eagerly and rapidly the food which should be eaten leisurely and enjoyed, has a strong influence upon the integrity of the child's health, and it should not be allowed under any circumstances. Constant nibbling between meals should be forbidden by both parents and teacher. A half hour's play should be given between the eating of a meal and the beginning of study. Children should not be allowed to gulp down their meals in order to have more time for play. An enforced presence at table or lunch basket for the time necessary for slow consumption of food will soon regulate this matter."

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* While reading the proofs of this article, the writer had opportunity of watching some school girls, about twelve years old, trudging home from a New York public school, carrying packs of books so large and heavy that he asked the children to allow him to weigh them. In one of these packs there were about a dozen printed books, as many copy books, and a large geography. This pack weighed 11½ pounds! It was admitted that the children, pupils of a Fourth Grammar Grade, did not always carry quite as many books; but when the regular pile was weighed it was found to represent still a load of over seven pounds. The books were needed on account of the home work required. Do teachers and principals who oblige growing children to carry such heavy and bulky packages home and back to school, realize for how many cases of strain, scoliosis, and other ailments they make themselves responsible?

† An English surgeon calls attention to the great discomfort, or actual injury, caused by ill-fitting garments worn by a growing child. Clothing for young children is usually made in large quantities at a time. All the garments of the lot are cut after a fixed pattern, the different parts being pieced together rapidly and stitched by machine, all at the least possible cost. The clothes are usually graded acording to age instead of by size, and so a child who is larger or smaller than the average for his years gets a misfit. But even those whose size and age agree are often no better off. The parent may notice that the child stoops and cannot be made to carry itself erect. Some one, perhaps the family physician, may suggest that the frock is not loose enough, but the mother demonstrates to her own satisfaction that it is by gathering up folds of the garment in her hand or by running her hand under it. But if the frock is removed and measured front and back, it will be noticed that the measurements over the chest and the back are the same; in other words, the armholes are directly in the center. If the child's arms were also directly in the center, the shirt or blouse would be an excellent fit; but the child's anatomy is not so ordered, nature having intended that its chest should bulge out to make room for the lungs, while the back should be flat and more or less rigid. Cf. Child Study Monthly, April, 1900.

The latter point is important; insufficient chewing and salivation is responsible for much dyspepsia. As many parents are often too ignorant or too poor to make proper provision, and as even well prepared lunches are likely to become stale before they are eaten, the furnishing of meals (breakfasts and luncheons) has become a well established institution in many schools. Edward Atkinson has instituted a regular system of midday meals for the schools of Boston. The warm luncheon experiment in the three high schools of Cincinnati is succeeding admirably, as the School Journal of Feb. 18, 1899, reported. In each of the schools are two long tables, one in the upper hall for the girls and one in the basement for the boys. (It is not quite clear why boys and girls must eat at separate tables!) The food consists of sandwiches, soup, warm hash or stew, assorted cakes, and hot tea and coffee. The pupils cannot spend more than ten cents on a meal, and they can get a good one for five. There was a cooking department in one of the high schools, and the teacher in charge cooperated with Superintendent Morgan with the establishment of hot luncheons as a result. As early as 1892 the same journal reports that in France school children take their midday meal at a public table provided by the state. They pay for what they eat with counters bought by their parents at so much a dozen. Parents who cannot pay are provided with counters free, which their children pass in without their schoolmates knowing that they are eating the bread of charity. Thus every child is sure of one good meal a day. "There is a wonderful sympathy,' says the School Journal, "existing between the midday lunch and the afternoon brightness of the children." In many other places similar experiments have proven decidedly successful. That proper attention should be given to the matter of regular and complete digestion, may be remarked in passing.

What has been said so far refers, it seems, exclusively to the welfare of the pupils of the school, and appears to imply that the teacher is beyond the reach of unwholesome influences, that he has an iron constitution both mentally and physically, so as to be altogether unconcerned in provisions of a sanitary nature, or in the hygiene of instruction. And yet, we know well enough that this is not the case; that if the pupils suffer from unhygienic conditions, the teachers are sufferers also. Especially as he is mostly a she, the severe physical and mental tension to which the teacher is exposed creates havoc in the delicate organism which often strives in vain to adjust itself to abnormal demands and circumstances. There is a long record of breakdowns and nervous collapses, temporary disablements and lasting injuries. Yea, even though it may not always come to such serious consequences, the unhappiness, worry, and morbid moods in the teacher, which reflect themselves so unfortunately and mischievously in the spirit, temper, and work of the children and which form, indeed, the worst unhygienic conditions for their activity, are sad enough to observe and easy enough to explain by prevailing unwholesome influences. There is unnecessary overwork, an overburdening with harassing details, an overabundance of wearisome rules and regulations, too much cramming for examinations, and monotonous, pedantic work with the children, often lack of inspiration from the head of the school, or of the school system, or from the school board, or from the community at large; and last, but not least, there is the irritating uncertainty with regard to the tenure of position, in spite of faithful and effective work, and the ever pressing financial anxiety caused by insufficient salaries which, in some states, are on a par with the cost of maintaining paupers.

Better sanitation of schools, better hygienic conditions generally, more rational and elastic courses of study, and all those things which will make the school life of our pupils more normal, more healthy, more certain of good results, and above all happier, will also favorably react upon the teacher. Even he is, as it were, a human being. And let us remember that upon him and his normal condition depends the greater part of the influences that shape the school life of our children. He is, even in matters of the hygienic administration of a schoolroom, the executive officer whose ability, intelligence, faithfulness, consideration, and ready tact are determinative. The very best hygienic equipment and the most psychological course of study will remain ineffective without an effective management and careful application by the teacher. And from him must radiate those inspiring influences which set the mental and moral organism of the child into normal activity to secure normal progress and higher differentiation. In applying our best hygienic knowledge to the needs of the teacher as well as of the pupils, let us remember the incontrovertible fact that, after all, the teacher is the school.

REPORTS OF THE COUNCIL.

April 12, 1902—Present: Drs. Savage, Taylor, and Gulick, Miss Bancroft, Miss Beiderhase, Mr. Haug, Mr. Bolin.

The minutes of the preceding meeting were read and approved.

The following were elected to membership: O. M. Babbitt, Harry Booth, Dr. Alice H. Bassett, E. C. Earle, E. H. T. Foster, Louise H. Livermore, A. U. Morris, Georgiana Richardson, Willard A. Sanford, Linden P. Smith.

A communication was received from the Librarian of Congress requesting a copy of the American Physical Education Review as currently issued. Referred to the Secretary with authority. The Secretary was instructed to copyright the Review hereafter.

The report of the Treasurer, showing $30.30 on hand, was read and approved.

The editor of the Review reported advertising matter in hand; also that the September number of the Review was ready for page proof; also that material was quite well in hand for the succeeding number of the Review.

The President reported that, in accordance with the action of the Council at its last meeting, he was in communication with local societies with reference to the next convention of the A. A. A. P. E., but that there was nothing as yet to report.

The Secretary reported the necessity for securing suitable storage room for the accumulated publications and other material of the Association. The securing of suitable accommodations for this purpose was left to the Secretary with power.

The Council adjourned to meet the first Saturday in June, unless necessity should arise for an earlier meeting to be called at the discretion of the Secretary.

JESSIE H. BANCROFT, Secretary.

ABSTRACTS.

Athletics at New Paltz.—There is a growing recognition of the fact that properly supervised athletic sports are a valuable feature in the moral and mental as well as physical development of the students in any school. It is important to lay stress on the words "properly supervised," for without careful supervision athletics undoubtedly can do much harm.

The State Normal School at New Paltz, N. Y., believes most thoroughly in physical education through athletic sports, and has a most efficient and well organized athletic association. Careful provision is made for proper coaching and for the proper supervision of the varied interests of this association, with the result that the young men have met with marked success in their baseball and football, and the young women have attained some distinction in basketball. Twelve basketball teams have been organized during the present season, including five amongst Cuban students attending that school.

An interesting phase of the athletic spirit at New Paltz is the way in which the faculty brings its influence to bear upon the matter. For instance, it has been ruled that no student who is deficient in his or her studies may represent the school on any one of its teams. The rule reads as follows:

"One E in a five weeks' report or two D's in a five weeks' report, or D in the same subject in two consecutive five weeks' reports make a pupil ineligible for any official position in class or in school, including that of serving on a committee, or for any other position of privilege or honor in the school, including a place on musical clubs, or on *athletic teams*. A student who has fallen below passing standard can reinstate himself by showing decided improvement in scholarship."

It is to the credit of the school that this rule is not a dead letter. Thus, on the eve of one of the most important basketball games played at New Paltz this past winter, namely that with the New York Normal College, it was found that three of the best New Paltz players were deficient in their standings. Without hesitation they were withdrawn from their team and substitutes took their places.

Another significant feature is that while the faculty will not allow low-stand students to play, it is just as insistent that those who do play shall play their best and represent the school with credit. Principal Scudder often tells the students that it is not essential that they shall win, but it *is* essential that they shall play a creditable game. He says that they have no more right to play a poor game than one of the faculty would have to go off and make a poor speech; that when they meet with defeat because of poor playing it is not the team alone that suffers disgrace, but the faculty and hundreds of fellow students and friends; that, as defeat usually means lack of sufficient preliminary practice, the school has a right to demand that those who accept the responsibility of playing on an athletic team shall practice faithfully, rain or shine, beginning early in the season and keeping at it to the end, and that if they are not willing to undergo all the sacrifice and hardship incident to such work, inconvenient and irksome as it often is, they must not ask to be allowed to represent the school and to play under the school colors.

The following letter recently written by him is self-explanatory.

"New Paltz, N. Y.,
"March 3, 1902.

"President Athletic Association,
"New Paltz State Normal School.
"Dear Sir:

"It has come to my attention repeatedly that one of the representatives of this school who played basketball at Kingston last month not only did not do his best but actually shirked in the game. Therefore, I, as principal of this school, and by virtue of my position the chief guardian of its interests, feel obliged to request you to investigate this matter most carefully, in such manner as the Athletic Association or its officers may prescribe, and to take such action on the findings as the occurrence may seem to demand.

"I also request that an investigation be made as to the reasons for insufficient practice on the part of the young ladies' basketball team.

"Myron T. Scudder, Principal."

This letter was read before the entire school and caused a sensation. But the Athletic Association took it up without delay, and the investigation is now in progress, the committee being composed of two members of the faculty together with the captain of the ball nine, the captain of the football eleven, and the editor-in-chief of the school paper. Whatever the result of this investigation may be,* athletics will hereafter have a new meaning for many of the New Paltz students.

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* Since the report was written a decision has been reached. The committee, after carefully sifting the evidence, declared that both guards were found to have shirked their duty and thus had been chiefly responsible for losing a game that ought to have been won by the New Paltz boys, since they were larger than their opponents and had already beaten them once. When this report was laid before the Athletic Association, it was moved and unanimously carried that these young men be deprived of the privilege of wearing the school monogram upon their sweaters and caps until they should again earn a title thereto. It may be said in explanation of the wearing of the monogram that it is permitted only to those who have played in three match games.

Since the school insists on playing bona fide members only on its teams, it expects that the schools with whom it exchanges games shall do the same, and the baseball manager not infrequently includes in his letter of challenge a clause something like this: "We beg to add that, according to our rules, only those are allowed to play on our teams who are bona fide members of the school, and no student is allowed to play who is deficient in scholarship. We hope you will match us with a team similarly composed."

New Paltz also goes on record with the following communication:

"The development of a healthful spirit in athletics is an impossibility unless all the schools that exchange games are agreed that only bona fide members of the schools are to be allowed to play on the teams. The practice of employing outside help on a school team is pernicious, for it not only prevents certain students from playing, but it takes away that pride in victory that is one of the joys of athletic contests. How can a school take any pleasure in a victory that is won with the help of those not in the school? It certainly is a sure way to bring dry-rot into athletics to introduce this species of professionalism into a school, and we call upon all who see the matter as we do to join with us in an effort to rid the schools of it."

It is undoubtedly true that athletics are largely overdone in many schools and colleges in the country, but it is equally true that athletics have come to stay. Let the people fulminate and protest as they please about it, but it will be of little avail. Much wiser would it be to direct constructive energies toward fostering the proper kind of athletics, regulating and supervising them in such a way that they will be a power for good in the school.—The School Journal, March 29, 1902.

Educational Results of Child Study.—In treating the question of "What Child Study has done for Education," Principal William Scott, of the Toronto Normal School, gave the following summary of results before the Dominion Educational Association, at Ottawa:

1. Child study has freshened and heightened interest in children, and has inspired the teacher with a greater reverence for the little lives entrusted to her care.

2. It has shown that many so-called stupid children are suffering from growths in the nose or pharynx, causing them to hear imperfectly. These can be removed by a surgeon and the child at once becomes normal.

3. It has shown that fine writing, small straight-hand draw-

ing, the intricate work of some kindergartens, and the use of the fingers in carving in manual training with young children, are all contrary to the law written in their nerve centers.

4. It has shown that the strongest potential capacity in the child is that for action; that this capacity for action takes the direction of imitation, and hence every one who comes within the ken of the child becomes his teacher.

5. It has shown that each organ has its nascent period, and that neglect at any stage of development is always expensive; that periods of interest correspond to the nascent periods of the motor organs; that the time of interest is the time of opportunity, and that neglect of this opportunity results in irreparable damage.

6. It has supplied many useful lessons regarding fatigue: e. g., mental fatigue is sooner induced where work is distasteful; the body wearies quicker when the mind is tired, and the mind more quickly when the body is tired; hence to secure the best results with the greatest economy of time and effort, pupils should work well when at work, and frequent periods of rest should be provided, etc.

7. It has demonstrated that formal physical exercise such as drill heightens rather than dispels mental fatigue.

8. It has shown that the time of physical growth is also the time of mental acquisition, and the old notion that rapidly growing children, if normal, should be removed from school, has been thoroughly disproved.

9. It has shown that the period of adolescence is of supreme importance; that youths are now vulnerable to all kinds of temptations, and that genuine sympathy is necessary at this time to assist the youth into full manhood or womanhood.

10. It has shown what can be taught to a child, and that children are much more interested in what an object can do and what it is good for than in its visible aspects.

11. Because some children are eye-minded, some ear-minded, and others motor-minded, it is impossible to teach all in the same way.

12. It has shown that it is impossible to teach morality by mere word of mouth, and has given the quietus to those who think that what is in the intellect must necessarily be in the heart and find expression for itself in the conduct.—The School Journal, June 14, 1902.

Corrections of Speech Defects.—The Brooklyn Medical Journal for April, 1902, prints an excellent article on this subject, founded on six years' experience in state schools for the deaf and private teaching. The writer, Olive E. D. Hart, lays special stress on the establishment of correct position of the vocal organs in the utterance of individual sounds. It is her experience that in such cases the chest is flattened so that correct carriage and the abdominal type of breathing is insisted upon. Mouth breathing is found to be very common. The main exercises, apart from respiratory movements, are those of vocalization. She dwells on the necessity of cooperation in the pupil and teacher and the importance of good home influences in curing the condition. In speaking of improvement, she truly says, "A habit of this kind cannot be formed in a day any more than any other habit can be settled upon one for a lifetime in a day."

R. T. M.

BOOK NOTICES AND BIBLIOGRAPHY.

Les Bases Scientifiques de l'Education Physique, par G. Demény, professeur du cours d'Education physique de la Ville de Paris, et de physiologie appliquée à l'Ecole militaire de gymnastique de Joinville-le-Pont.

I volume in 8° de la Bibliothèque scientifique internationale avec 193 gravures, cartonné à l'anglaise; 6 francs. Paris; Felix Alcan, editeur.

Professor Demény furnishes a much needed work on the scientific bases of physical education, and has treated his subject in a sane and liberal manner. He shows that physical education is an essential part of general education and deserves support on similar grounds. After the preliminary sections the work treats of the effect of exercise on the principle bodily functions, with special regard to respiration, training, and fatigue. Posture is then discussed with particular reference to the shoulders, back, and abdomen, and with frank criticism of conventional methods; but, as in all treatises known to the writer, the subject is insufficiently developed. The rôle of the nervous system in exercise is emphasized, and stress is laid on the effect of systematic exercise on character. The author believes that insufficient muscular development has played a considerable part in determining feminine traits. He rejects athletics and gymnastic feats as an integral part of physical training, relying upon harmonious development in accordance with scientific principles. The concluding section of the book on anthropometry is brief and unsatisfactory, and in all, the work done outside of France is inadequately recognized. The book seems indeed more valuable as a document indicative of the status of physical training in France, than as the well-knit treatise fully abreast of contemporary thought and work which we are all anxiously awaiting.

H. L. T.

THE JOURNAL OF CHILDHOOD AND ADOLESCENCE.

This vigorous young magazine is edited by Prof. Albert H. Yoder, of the University of Washington, and published quarterly at Seattle. The April number contains several articles of deep general interest.

"Children's Attitude toward Punishment," by Will Grant Chambers, gives the results of a study of the children of a community in the northwest, settled almost exclusively by Scandinavians, by the method followed by Earl Barnes some years ago in a similar study of California children. The results are compared with those obtained by Barnes. The fact that 78½% of all the punishments mentioned as having been received by the children embraced in the study were for breaches of propriety and conventionality is suggestive. Do not the schools create, by means of needless arbitrary regulations, offenses which have little to do with right and wrong, to the confusion of the moral sense of children? The statistics indicate that these Scandinavian children are less given to truancy, fighting, and neglecting work than the American children who were the subject of Barnes' study. Only 7% "detect a higher form of justification", for the punishment received, "in the reformative influence on the offender or the remedying of the harm done. This last idea appears first at the age of nine, and culminates at the fourteenth and sixteenth years at about 14%". "The idea that punishment somehow balances offense is the most frequent justification, and persists, with only slight decrease, throughout school age in this community." Then follows a statement of some differences of race characteristics as shown by this study and that of Prof. Barnes, some of which may perhaps be questioned; but the writer is surely right when at the close he emphasizes the fact that "child study must always be a local matter. Certain broad tendencies may be found everywhere, but they can do little more than mark the boundaries within which more careful (detailed?) local studies may be conducted".

"Hearing Defects of School Children," by Charles C. Krauskopf, of the Child Study Department of the Chicago Public Schools, shows that defects in hearing increase very rapidly from the beginning of school life and culminate between the ages of eight and nine; then they decline until the age of thirteen or fourteen, after which there is little variation. The writer attributes this rapid early increase largely, but not wholly, to the adenoid growths "which seldom attain a dangerous size before this period, and rarely appear after the beginning of adolescence." The facts show which grades need special attention when "eyes and ears" are examined by medical officers. T. M. B.

THE PAIDOLOGIST.

This periodical, edited by Dr. Oscar Christman, and published at Emporia, Kansas, is one of the magazines devoted to child study which have made their appearance within the last few years. The editor coined the term "paidology" to designate the scientific study of children, and he explains at length in the first number how he came to do so.

"The Feelings and Actions of Boys and Girls for One Another"—a symposium—in the second number of Vol. I, contains many points which are suggestive to grammar school teachers. The contributions are not all written in good English. T. M. B.

THE POSSE GYMNASIUM JOURNAL, APRIL, 1902.

The Value of Gymnastics. Medical Gymnastics (continued). The Warner Physical Education Bill in Ohio. A Brief Exposition of the Effects of the Types of Exercises in Swedish Gymnastics. The N. E. A. Convention. Gymnastic Exhibition. A New Use for the Telephone. Sunburn. Here and There. The Summer Course in the Posse Gymnasium. M. K. W.

EDUCATIONAL REVIEW.

Vol. 23, No. 4 (April). Moral and Religious Instruction in France, by J. C. Bracq. What Shall the Small College Do? by Albert P. Brigham. Lectures versus Recitations, by F. C. French. Cost of an Academy Education, by Clay Herrick. Education and Social Progress, by Ira W. Howerth. Normal Schools of Japan, by Merton C. Leonard. My Schools and Schoolmasters, by Richard Edwards. History Teaching in New York State; a Report prepared by Inspector E. W. Lyttle of the University of the State of New York. The Classics in Modern Education, by William Baird.

No. 5 (May). Some Social Aspects of Education, by G. Stanley Hall. Educational Tendencies, Desirable and Otherwise, by Andrew S. Draper. Industrial Education as a Social Force, by H. W. Stebbins. Educational Conditions in the Southern States, by Robert C. Ogden. Elective Studies, by Edwin P. Seaver. Education North and South, by Charles W. Eliot. The Relation of Education to Industrial and Commercial Development, by Howard J. Rogers.

Vol. 24, No. 1 (June). Scholarship and Service, by Nicholas Murray Butler. Shall the State Restrict the Use of the Terms College and University? by Andrew S. Draper. Francis W. Parker (with portrait), by Frank A. Fitzpatrick. School Instruction in the Effects of Stimulants and Narcotics; a Preliminary Report of the Committee of the New York State Science Teachers' Association upon the Effects of Alcohol and Narcotics and upon the Instruction regarding them in the Public Schools. The Abolition of Compulsory Greek in Germany, by C. E. Wright. Bibliography of Education for 1901, by J. I. Wyer, Jr., and Isabel Ely Lord.

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AMERICAN
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Vol. VII. SEPTEMBER, 1902. No. 3.

THE EFFECT OF MODERN EDUCATIONAL METHODS ON THE HEALTH OF THE PUPIL.*

HENRY A. FAIRBAIRN, M.D.

Read before the Medical Society of the County of Kings, December 21, 1901.

In recent conversations with instructors in our prominent educational institutions, inquiry was made as to the reason for the increase in the amount of work required of the pupil. While it was acknowledged that, in many instances, the pressure on the latter was very great, it was explained that this was due to the demands of the times.

The school, we were told, was in a strait between two, the public on the one hand, and the college and university on the other. The pressing desire, you may almost say impatience, which increases year by year, to get to work, to enter upon the earning of a livelihood, has brought about changes in the old college curriculum. Another influence has been at work: a scientific study of the needs of the pupil has been going on and has resulted, it is said, in a better understanding of the subject from an intellectual point of view.

Formerly, the boy was compelled to pursue in college a certain prescribed course, the aim of which was avowedly mental training and development. The college occupied an intermediate step between the school or academy and the professional institution. It presumed that the boy entering upon its course had not yet determined, in fact, was in no position to determine, his future work. It undertook, therefore, to put him through a course of study which would so operate on his mind as to bring into activity and conscious agency the faculties which must be used in the affairs of life and the acquiring of a professional education. They are the memory, the attention, the judgment, the reason, the taste. It will be granted that the one who can exercise all these qualities in the affairs of life is the successful man. Without them, extensive knowledge will hardly profit much. Elementary instruction was the part assigned to the school; education, mental training, and development to the college.

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* Reprinted by permission from *The Brooklyn Medical Journal,* June, 1902.

This distinction between school, college, and professional institution, though well fixed in the German mind, is apparently not according to American taste and choosing. Both are agreed as to the object to be accomplished, the difference is in the method.

In this country, in some secondary schools and in college and so-called university, limited election of studies and, as they say, adaptation of the curriculum to the pupil rather than the pupil to the curriculum, are the working principles. It is maintained that thus is produced a much more widely, though perhaps less minutely, trained mind, than by the old method. We have the technical schools, many of them in connection with universities, with low standards of entrance, which receive students without any broad preparatory training whatever. A liberal education is not a necessary prerequisite. There is an attempt, therefore, on the part of secondary schools, colleges, and so-called universities, to abridge the old method of discipline and to advance their pupils as quickly as possible into higher branches. The college expects the school to do much of the mental training. It abridges this process, and gives special courses in technical branches, holding out the promise to the pupil that thus will be saved time and study in professional course. The public have absorbed this spirit of so-called enterprise and abridgement of what is come to be looked upon as the unnecessary old intermediate course, and willingly take an unskilled part in the selection of method. The result not infrequently reminds one of Lancaster's methods, which regarded the pupil as an empty vessel to be filled up with statements and, perchance, facts. "Cramming" is the apt term applied by the disgusted pupil. It at times is a forced exercise of the memory; and that function, strained to its utmost, is fortunate if it holds out sufficiently long to pour out its contents on examination day. That event over, it is not rare to find in its place a rather empty vessel. To go over a very large field in the shortest time possible, without much regard to real, sound training, appears to be the spirit of the day in these matters. That will not fulfil the prerequisites for a business life, a teacher's course of study, or that of a professional. The students looking forward to the various walks of life need, above all things, a sound training and thorough drilling in elementary principles, after which what follows will be of comparatively easy attainment.

To discuss educational methods, whether they be good or bad, whether they properly fulfil mental requirements is entirely out of my province. The prescribing of curricula requires special knowledge and special study, which must be left to the great teachers of the day. What, as a physician, I do desire to call attention to is the fact that it is not an infrequent experience, at the present time, to find pupils and teachers in modern schools suffering from the effect of mental strain. While the curricula may be as near perfection as possible, there is certainly a tendency to undue forcing. The time allotted to the pursuit of different branches does not appear sufficient to yield to the pupil the proper educational value. There result an uneasiness, and disquietude and uncertainty, which are not compatible with health of either mind or body.

The size of the classes and the large amount of prescribed work necessarily prevent thorough teaching and careful study, and make one suspicious that the very rapid commercial spirit of the day has invaded the class-room. There is undue economy in the teaching force, and an effort to make intellectual fortunes on a small investment.

Very recently I had the opportunity of watching a bright lad follow a course of study in a difficult subject. He came home every evening with a large number of pages to study, and these were repeated the following day as accurately as his memory would allow. There was little effort on the part of the teacher to impress upon the pupil's mind the principles involved. They were lost in the endeavor to memorize a mass of detail. There was, in fact, no time allowed for teaching. To finish the text-book, to pour into the youth as much as he could hold, appeared to be the end aimed at without regard to assimilation. Examination on this subject proved a stumblingblock to him and a number of his companions, and the summer vacation found him in the hands of a tutor, doing work which had been neglected in term time. The tutor reported an astonishing ignorance of the subject. Minor details in various chapters had been retained by the memory, but their explanation was wanting. Weeks of careful work were devoted to this subject, under the tutor's care, and the boy returned to his examination well grounded in the philosophy of the subject. What was his experience? He was again placed upon the text-book rack, and tortured with questions on minor detail and allowed to pass by the smallest margin, simply because he was unable to repeat, verbatim, the various sections and illustrations there given, though he proved a master of the principles and capable of applying them.

What did this course in school profit the youth in question? Did it benefit his memory? On the contrary, it overtaxed and injured it. Did it stimulate his attention? You might answer, with all truth, that it illustrated to him its futility. What have we to say as to its effect on his judgment and reason? They were retired from service for the time, and his taste, his relish for the works of nature and art, must have been blunted. Or, in other words, we find that it did not fulfil a single object in instruction or education. If one search for the reason for this failure, he will find it in the too great size of the class, to begin with, and secondly, in the attempt to cover too large a field. However willing the teacher might have been to instruct and drill his class, the opportunity was removed by the conditions imposed upon him. The effect on the boy's nervous system was manifested in irritability, weariness, and loss of confidence.

The time of home-work has been prolonged of late. Parents inform us of hours spent, after school hours, by their children, over difficult lessons, and their own attempts to supply the drilling or teaching which has been lacking in the class-room. As examinations draw near, sickness, traceable to overstrain, comes frequently to the family physician's notice. The history runs as follows: Firstly, abnormal irritability and weariness; secondly, disturbance, or failure of digestion; thirdly, interference with nutrition; fourthly, anemia; and then, if the case is not attended to, a long train of symptoms, headaches, neuralgias, hysteria, and nervous manifestations, or, perhaps, some of the various infections which are liable to occur in persons with lowered powers of resistance.

"The National Educational Association, composed of teachers of all classes and from every section of the country, numbering now some sixteen thousand, has assembled annually for the last thirty years to discuss the question of instruction and education in its various departments. The problems connected with secondary education have been vigorously attacked by them. Through a committee of ten, composed of men of distinction in the educational field, college and university presidents, professors and high school principals, the whole question has been thoroughly investigated by numerous conferences with instructors all over the land who had attained a reputation in the special subject under consideration. The result was a recommendation of courses of study, in the form of schedules generally agreed upon." As a product of the best scholarship, it is of supreme value. But the committee was careful to lay stress upon the fact that, in order to be of benefit, there must be sufficient time given to the various studies and a good quality of instruction. Their task would have been well rounded out if they had taken care to inform parents of this final admonition, then would the schools be relieved of one source of their apparent embarrassment in the decreased demands from that quarter. It might have had some effect, secondarily, on the college and so-called university pendulum to regulate its wide excursions. Of benefit would it have been to the overworked teacher, who, quite as frequently as the pupil, exhibits symptoms referable to overtaxed nervous system. There is no more fruitful source of exhaustion in its various forms than the attempt to work out a task impossible of fulfilment. As the trainer of an athlete is careful never to overtax the physical powers, for fear of organic trouble and subsequent defeat and incapacity, so is it quite as necessary for the teacher to beware of mental strain in pupils, the penalty in case of the latter being quite as great as in the former, namely, failure and incapacity in their various degrees.

REFERENCES.

"The Meaning of Education," by Nicholas M. Butler; "College Education," by Noah Porter; "Regents' Report of University of the State of New York"; "Education and the State," by F. A. P. Barnard; "Address on Education," Rev. Francis Vinton, D.D.

DISCUSSION.

The President—This subject cannot be considered with entire profit from a medical standpoint, pure and simple. Some of our educators have been good enough to come here to-night, and perhaps it will be best to alternate in the discussion. One of the best, perhaps the best, known engaged in this work is the principal of the Erasmus Hall High School, Dr. Gunnison.

Dr. Walter B. Gunnison—Mr. President, and gentlemen of the Medical Society, it is with very great pleasure that I accepted the invitation to be here to-night to discuss the subject of modern educational tendencies, or methods, in regard to the health of the pupil, and to discuss them from the educational standpoint. I have often thought I should like to discuss modern medical methods from the educational standpoint. We who are engaged in educational work have come, sometimes, to feel that the doctors, who are engaged in the same work that we are, that is, the proper development of our youth, have not always confined their attention to the physical side, and left the mental and intellectual development to the educational side. We have felt very many times that the shoemaker did not stick to his last, and that the interference we have had on the educational side from the medical men has sometimes looked as though they had been interfering with the peculiar function of other specialists. For instance, we have a large school in which we must regard discipline as one of the necessary things in the training of our youth, and we feel that the training of the will is just as important, perhaps, in the welfare of the child, as the care of the ordinary physical ailments. When we find that our whole method of discipline is ruthlessly invaded by a doctor's certificate, and we are obliged to throw aside all our plans for this, we sometimes, I say, feel that we have a reason for criticising the position that the medical men are taking.

When a pupil who is habitually late, and is thereby forming bad habits of conduct which we as educational men feel are about the most serious injury that can come to the child, and still we are obliged to say nothing, because the doctor says it is right for these pupils to be late or careless, for some reason which he does not give to us, we feel then that there is something the matter. When our school authorities have laid out the school year, and we have planned our school work for that year, and arranged this in such a way that it really ought to have a year in the taking, and when, about a month or six weeks before vacation, in the middle of May or the first of June, fond mothers come down and say the doctors tell them that their daughters should go off into the country, and lose about six weeks—and they want us to promote them just the same—we feel that the doctors have interfered with the educational system somewhat, and that possibly they have not given quite respect enough to that system; they have looked at the medical side without regard to the other side, which is just as important.

The practical grievance that I have against the doctors in the school is when a child is overstrained, when there is no question but that the child has been overstrained, and I get a certificate or a long letter from the doctor, as I often do, saying the child cannot do so much work, and, therefore, she must drop her Greek—it seems to me then the doctor has passed judgment on a matter that is really not medical, but is educational. I feel that a letter of that kind should be received, of course, for its full face value; that when the doctor says a child has been overstrained in the work, and that the work must be lightened, he has done his full duty as a medical man. It does seem to me really a little strange that the doctor should say that the particular subject must be dropped which I happen to know is the one that the pupil does not happen to want to take, and that he has simply fallen in with the whims of the pupil that I have been struggling with for years. That is one of the most common occurrences. My answer usually is this: That we accept the certificate in full for all that we claim the medical man has a right to say. If he says the child should not study more than one hour a day, we are willing to keep the work down to one hour a day. If he has to take half the work, all right, but when it is said that the particular study of mathematics, for instance, has a more wearing effect on the nerves than the study of Latin, it seems to me that is a case for another sort of doctor—not an M.D.

However, as I said at the first, I am delighted to be able to present at least one side of this matter, and I wish to say that I am at the same time exceedingly pleased that the Medical

Society has considered it worth its while to spend an evening in discussing a matter that is so largely educational. We hope that some education will come to the Medical Society by reason of giving attention to this matter.

I agree very fully with the paper in most of its conclusions, and yet it seems to me that the subject is a misnomer. When it says that this is the tendency of the modern educational methods, and when it describes methods that have been discarded for fifty years, it seems to me that we should regard this as ancient history rather than modern history. I do not think there is an educational man in this city who would for a moment say that the method as indicated by that paper in the subject of history, or in any subject, in fact, in which the memory is used largely, is the method that has been recognized for twenty-five years in any respectable educational circle. The fact is that the educational men of the country begin to feel that they have gone too far away from just this method with which fault has been found, and that we have slighted the memory, rather than dwelt too much upon it, and that the memory work of the schools to-day is the poorest work that is done in the schools. I believe the pendulum has gone too far, and that we ought to swing back, and have a little more of the cultivation of the memory than we have. Certainly the picture which is drawn in the paper as being a view of the educational methods of the present day I must dissent from.

Now, as to the general use of the text-book. The educational men throughout the country to-day are urging the use of more text-books. We really are not using them enough. You take in the secondary work—I will speak particularly of that—in the matter of geometry: I believe to-day the method used generally in the best schools is not the method by which you were taught, or I was taught, the taking of a text-book and committing the demonstration, but, the fact is, there is no text-book in geometry used at all. A problem is given to the class, but they work under the direction of the teacher, and the result is not one demonstration, but twenty demonstrations. The work of the teacher is not to see that it is memorized, as I say most of you learned it and as I learned it, but simply to see whether the operation is a logical one, and that the demonstration is complete.

In the matter of the classes in Latin. Twenty-five years ago I was teaching Latin. I know it was regarded as something novel almost at that time to use the Latin language from the start. I remember the first book almost that had any general circulation throughout this country, in which, from the start, the language was used by the pupil. There is not a school in the country to-day that does not start with the language, and the grammar is a thing that is simply absorbed during the three or four years of college preparation. I visited a school this summer, in London, and found there the method of Latin instruction that was found in this country twenty-five years ago. The class had been studying a year and a half, or two years, and had at that time never seen a Latin author, and was unable—as far as I could judge from the examination, and from the statement of the teacher—to read any Latin text. That was the treatment at the time which the writer of the paper evidently had in mind.

Now, how is it with Latin to-day? At the end of the first year the classes have read at least one or two books of Cæsar, and I want to say that they are reading it in better shape than you did twenty-five years ago, after having a year or two of special preparation. I know this from my own experience. I was a teacher of Latin for about ten or fifteen years, and when I took up the new work in which I am now engaged, I took a class in Latin, and I was amazed to find, as compared with the pupils of twenty years ago, the amount of language which the pupils to-day had read. The educational methods of to-day are infinitely better, as a whole, than the methods of only a short twenty or twenty-five years ago. Of course, as compared with a longer period, there is no question whatever. This decrying of modern educational methods I believe is not sound.

Now, in regard to the effect on the health, is there any possible way of determining that the present methods have any worse effect on the health of the pupil than those of ten or twenty years ago? I do not believe there has been any more healthful body of children at any time in the schools than at the present time. Of course, we have not attained the perfect system; no one knows the weak spots in the present system better than those engaged in it, and I do not think the modern educational methods, as applied, are of a nature to affect the health of the pupils of the day.

As far as crowding them is concerned, we *are* crowding certain pupils, but I think this is true—that the *over*-strain of the pupils, as a whole, is not so great as the *under*-strain of the pupils in this city. The fact is, the pupils do not study enough. I do not believe the pupils of this city spend as much time on their work at home as was spent ten or fifteen years ago. Your boys are not suffering from overstrain, they are suffering because we do not give them work enough to do. We are doing too much work for the pupils in the school, and the pupils themselves are not doing enough. That is my firm conviction. In the high school a great portion of the work is absolutely done in the school. These pupils are from fifteen to nineteen, and if we can get a couple of hours' study outside of the five hours in the school, two hours or two and one-half, which is the maximum that we are allowed to require by law, we consider ourselves fortunate. I think there is no pupil properly fitted for the work who, with two hours of preparation outside the school, cannot carry his work. Certainly I cannot believe any one can think that is too much work for a pupil who is really fitting himself to take up his lifework; it will be the smallest amount he will ever do. When he goes into the professional and technical schools, the work he has done in the high schools will be simply play for him as compared with the work he will then be obliged to do if he does the work that is expected of him, and if he expects to take any rank.

Now, of course, what leads me to feel and believe that this is true is the great increase in the amount of work done, and the character of the work. Is there any question that the graduate of the high school of to-day is years in advance of the graduate of twenty-five, or thirty, or forty years ago? Why, there is more science taught in Erasmus Hall to-day than in any college in these United States fifty years ago. There is no branch in the curriculum of the high school to-day but has doubled and trebled, with the exception of the classics and mathematics—doubled and trebled, and still the age of the pupil, while it has increased the age of graduation from the high school and entrance into college, certainly has not increased in proportion to the extra amount of work that is done.

Of course, this overstrain of pupils is a very serious question. Their principal has a long list of pupils who, he knows, are doing more work, and work of a character which ought not to be done, and who ought to do less, but I want to say this, that it is not the educational system that is keeping these pupils in. It is, I fear, because the medical profession, perhaps, has not trained the parents to this condition. I give more time, I think, and I have more often asked parents to have their children drop some of their work and take a little longer in doing it, putting it solely on the question of health. I do that a dozen times to once where I call upon parents to urge them to do more work. The trouble is not with the educational system; it is on account of the urging of the people, the demand of the times to force more work than can properly be done.

There is one matter that has been referred to in the paper that I feel is one of the greatest evils, and it seems to me that the medical profession, if they would join with the educational side, could do more in that direction to help the health of the pupil and give a thorough mental development than in any other, and that is, the allusion that was made to the size of the classes.

In our graded system, while it seems an economic necessity almost in a large city, it has been developed to such an extent that it is in my mind the greatest menace we have. While the people will make a great ado about the fact that pupils are not taken into the schools, it seems as though parents and doctors are perfectly satisfied the moment that the pupils are admitted and placed upon the rolls, whereas the fact is that in our crowded schools it is infinitely better for the children of the people of the city that they should roam the streets than that they should go into these classes, and there be overcrowded. The modern tendency of the times is certainly against this overcrowding; it is certainly against large classes. You will find no modern high school that will contemplate a class at most of over thirty, while in all our older high school buildings you will find hardly a room but has arrangements for over forty, and some even for fifty. To pretend to do educational work, of course, under such conditions is preposterous, and thirty is five larger than what I believe is the opinion of educational men throughout the country as to the maximum size of the class in secondary work. If this fact could be emphasized by the men that have the ears of the parents, an immense amount of good could be done. There is another thing that goes along with our educational system in which it seems to me the medical society could be very potent if they could take hold of it, as it is particularly in their line, and that is along the side of cleanliness. Our old buildings are largely unfit for the training of pupils. They are dirty, they are improperly lighted, the rules of the educational authorities in regard to the supervision of those schools, and the management of the janitors and their helpers, are entirely inadequate. If only a healthy sentiment would demand that our schools, instead of being the dirty places that the children go to, should be made beautiful, that every attraction that would help the children should be found in them—it seems to me that there an immense amount of good could come. Certainly the co-operation of the doctors and the educational authorities should be had if we expect to properly train the young of the land.

We must remember this fact, that it is not necessarily a kindness to these children to make the work easy for them. If we are going to train them, that of itself necessitates and means work. The arm cannot be strengthened unless the muscles are used, and if they are to become very strong they must be used with heavy weights. It is so with the mind. If we are going to really turn out robust, healthy, and intellectual young men and women we have got to give them training along these lines, and the easy methods are not going to turn out results that will be satisfactory.

Dr. W. A. Northridge continued the discussion by reading the report of a discussion that took place before the Pediatric Section on a previous date.

Mr. President—We have listened with great pleasure to the author's scholarly generalization of this most important subject. Now let us make the application.

Undoubtedly many excellent advances have been made in our school system. But it is evident to all physicians that the system is vitally wrong in part. The principle of cram, cram, cram, is a wrong one. We, as a body of physicians and as a body of voters, must use our great influence in this community to change this condition of affairs. We must order children taken out of school for a term more frequently than we do; that they may have a chance to develop physically. We must insist that home work be done away with entirely. This is of prime importance. If a child, after the hurry and rush of school work from nine o'clock till three, could be relieved from all thought of school until the next day, she would have a chance to recuperate, notwithstanding the physiologic wrong done her by the long hours of confinement.

As it is, the worry of home work undone keeps her in a nervous state during the time she is at play. Let us insist that no home work be given at any age. I understand that the schools in Washington have abolished home study this year. May the New York schools follow this excellent example!

Far better for this nation that the children develop healthy minds in healthy bodies, rather than crammed minds in more or less broken-down bodies. Here are some facts that it would be well for pedagogues and parents to bear in mind. A child is a rapidly growing, playing animal, very largely undeveloped, needing much food and rest, and easily overtaxed mentally and physically. Such a growing organism should be handled with strict regard for physiologic laws.

A young child is not capable of prolonged attention. Fifteen minutes to twenty-five at the longest should be followed by relaxation, or great inattention will result. Children find rest in motion. They should not be driven up to the limit of their powers. Parents are often to blame for this; also for allowing their children to sit up late and go into "society" before their time. It would be a vast stride forward if the number of school hours were shortened to two and a half for the younger children. Again, no child should be admitted to school until the age of seven years. The kindergarten is the place for the younger children.

The discipline as carried out in the schools is not always to be commended. Presumably without central authority, it is in part one of scholar espionage, tale-bearing and brow-beating. It is too exacting in little things and the penalty is, at times, out of all proportion to the offense. The suspension of the pupil at times for slight faults seems to prevail. For instance: Recently a seven-year-old boy, upon hearing the bell, skipped, actually skipped across the play-yard to his place in the line. For this he was reported by the monitor and, although he bore an excellent character as to conduct, he was suspended and sent home. Feeling the disgrace keenly, fearing a whipping and crying bitterly, he took refuge with his grandmother. His mother went up to the school and talked some rather plain English. A little girl ten years of age came home in tears. Being asked the trouble, said: "I left too large a space in front of me on the line, and I was reported and made to stand up before the whole department." The exposure so worried the child that she was ill and had the attendance of a physician for three days. Her mother informed me that her card was marked "conduct excellent" every month. These cases illustrate the strain under which children of tender years are doing their work. For these reasons I think, once the school hours are over, the child should have the eighteen hours that are left, to rest and play and develop in naturally. For no one will deny that the school life is perfectly artificial and unnatural.

At the November meeting of the Pediatric Section, Dr. Jerome Walker stated that under the present school system of education in the public schools, it is not strange that young teachers especially break down and that pupils are harassed. Teachers are obliged to devote just so many minutes each day to each subject; and they are carefully watched, and if their classes do not reach a certain average mark, if they do not manage to promote a sufficient number of pupils each term, they are liable to be reprimanded, degraded or transferred. Very few teachers, especially those not in robust health, can stand the strain for any great length of time. And besides, it is no light matter to have to examine piles of examination papers or note books.

Dr. C. L. Kerr stated: I do not uphold the present educational method in its entirety, although it is a direct result of this age of commercialism. We must always have some one or a body of men to lay out a general scheme best suited to the large majority of pupils; it is impracticable to devise a method of individual instruction of the public. The best we can hope to attain is a decided modification of present evils, which there is a tendency by our public instructors to do, to wit: the introduction of kindergarten work and the abolition of that nerve-racking inquisition, the examination. Work along this line seems to me to hold out the greatest promise of good.

A prominent member of this society also spoke as follows:

Study and mental training as such rarely hurt any one, either adult or child. It is the examinations, lack of individual instruction and sufficient explanation, eye strain, prize contests, bad air in school rooms, abbreviated sleep and feebleness of other origin that in great part cause trouble. In particular it is the examinations that are the bane of our whole educational system. They have become a kind of fetish. Of themselves they are of no use, teach nothing, are not a benefit to the individual. On the contrary, they are injurious to all and produce a maximum of bad effects; the same principle of fright that we see do harm in railway and other accidents. A certain degree of relief can come from a system of standard grading in the schools the country over, so that grade certificates shall be accepted at the same value everywhere. In continental countries something of the kind holds, and here steps are in progress looking to that end. Most of our schools are arranged, not according to the one below, but according to the requirements of the one above. Hence modifications must begin at the top, and it seems to be the colleges that properly are taking the initiative. Even, however, though such a scheme was carried out for all stages of education, examinations will only be lessened in number, not done away with. An incomparably larger proportion of the teachers break in health—though, of course, they have been longer at the work.

Dr. Barber said: Dr. Fairbairn has presented a subject of no little importance. He has struck one of the major chords in the etiology of many breakdowns in both teacher and scholar.

It seems to me, from what I can learn of the present methods of teaching, that the idea is to place all the work they can carry upon the teachers, and they in turn unload upon the scholar.

For instance, we are called to a young patient who has been gradually failing in health, has been attentive to school duties, is industrious, equal to children of her own age in mental ability, and stands well in her class; we look about for the cause of the anemia and gradual decline in health. The patient, we find, started school in the fall in good physical condition, but soon began to look bad, to complain a little. You ask what she has to do in school, and find that the amount of time necessary to accomplish her home tasks is about all the hours there are left in the day between the closing of school and bedtime, the teacher being obliged to have the scholar accomplish just so much every day to comply with the arrangement or schedule held over her head. What must necessarily be the outcome in such a case? The results speak for themselves.

Where the fault lies is not my province to say, but certain it is that some one seems to be experimenting upon the rising generation at the cost of their lives in some instances, and their health in many instances.

Twenty-five years ago we spent from 9 to 3 in school, with an hour for noon. The nearby lots were used for recess playgrounds, and the children came back to school aglow with the indications of health upon their cheeks. Our lessons were not too many, enough to take up all the school time, and this with an hour or two in the evening at home, covered ground sufficient and covered it understandingly. Explanations by the teachers were frequent, and a subject was understood before turning to another theme. Now the matter is different, as it appears to me; few if any explanations are made, the scholars are housed almost all the time, as they have so much to accomplish that the day is too short for the performance of their home and school duties. It is absolutely impossible to have healthy children without plenty of out of door exercise, and if the burdens of school duties are to continue as they stand at present, we cannot look for a healthy future generation. The sooner the directors of educational subjects get back to the hardpan of all, the old three R's, the quicker will our young people be relieved from the intense tension they are now under. Fewer fads, more money for playgrounds, and more time for the young out of doors.

Just a word more, and that about our wonderful gymnasiums, physical culture. A little fellow enters one of our modern and well-equipped educational institutions. He is allowed two hours a week to be instructed in gymnasium work, one hour each on two of the five days spent in school. His exercise is active, he naturally becomes warm, and at the close of the hour is sent back to his class room to study or recite. I leave the outcome for you to imagine if you have not already had your experience. Aside from the deleterious results, how much development can be obtained from such an interrupted course of training? I say they should either do it, and do it well, or not attempt it at all. We must either have a revised course of instruction or else there must be found another class of scholars to undergo the present arrangements, for the average child is not physically strong enough to undergo the strain now required to pass through our schools. The present methods are physical wreckers.

Some one has said, let these matters be called to the attention of the proper authorities, perchance some good might follow; but when, a few years ago, the most unsanitary conditions of some of the schools were brought to their notice, no relief followed, and I have little hope of the present trouble being rectified.

In conclusion, I desire to make the following propositions:

First.—School life is, at the best, artificial and unnatural.

Second.—The principle of cram, hurry and rush is a wrong one.

Third.—Home work should be done away with entirely, or the school hours should be shortened. Two and one-half hours is long enough to keep the younger children in school.

Fourth.—Examinations should be done away with entirely.

Fifth.—A child under seven years of age should not be admitted to school.

Sixth.—Kindergartens should be provided for those under the school age.

Seventh.—The discipline should be made less severe, less military in character.

Eighth.—Teachers should have less work to do and a smaller number of scholars to care for.

Ninth.—A system of standard grade certificates should be had.

Tenth.—Less should be attempted to be taught, and that well taught.

Eleventh.—Physical culture should be taught according to the laws of physical development. The physical culture a child needs, the child will get if you give it room enough and time enough and freedom enough, for to play is natural to all.

Twelfth.—Let us remember what Sir Benjamin Richardson has well said: "The endeavor to fill the minds of young children too hastily with artificial information leads often to serious disease, especially when the laws of physical development are constantly broken."

Mr. William McAndrew—Mr. President and fellow physicians: You, of the body; we, of all that you leave; the hospitality of this Society is indeed refreshing. You welcome one who belabors the schoolmaster, and then you welcome the schoolmaster who belabors back. I am reminded of the city where I lived when a boy—Detroit. It has become a great city for conventions. They have now upon the City Hall in electric lights all the year around, the word "Welcome," and when any particular convention is in the city they compliment that body by putting its name under the welcome, also in electric lights. One week you will see: "Welcome, Woman's Christian Temperance Union"; and the next week: "Welcome, United Brewers and Distillers." (Laughter.) I visited home last year, and a convention was in progress. The sign read: "Welcome, Michigan Physicians and Surgeons." When I left home, the next week, it read: "Welcome, United Undertakers and Embalmers." (Laughter.)

As the son of a physician, as one who once attempted to be a physician, and as one who has been brought up amongst them, I try very hard to have respect for them. (More laughter.) I remember once, when a country boy came up and took dinner with us, and he refused to take any butter. On being pressed to give a reason why, he said: "Mrs. McAndrew, I don't care for any butter; I see it made every day." My experience with doctors has been similar. I am trying to have respect for the opinions on our schools that have been presented to you by the speakers this evening. Before I sit down I think I shall have brought myself into a thoroughly respectable mood regarding them.

I will endeavor to speak first of the thesis which Dr. Fairbairn presented, wherein he said that the work of the schools is admitted to be very excessive. Don't you remember this subject coming up in Brooklyn about four years ago, in regard to the work of our Girls' High School? A society of physicians presented to the Board of Education certain complaints as to the overwork of the young girls in the high school, and the Board of Education appointed a committee that had upon it, I think, all the physicians there were in the Board at that time. It consisted of the Committee on Studies and the Committee on Health. They went very thoroughly into an investigation of the question of overwork on the part of the young women at that time. They got reports from 2,250 girls as to the amount of time spent at home on study, and the average was two hours and ten minutes per day on home work. Four-fifths of the girls reported that they devoted less than two hours to home work. It was found that no girl in the school had more than three subjects that required home study. The other subjects were of a varied and recreative nature, such as the third speaker advocates. It was found when the physicians who had made the complaints were brought before the committee, that they themselves admitted that two hours per day of work at home was not excessive, and the report concluded with this very significant statement: "When we consider the amount of time that is being spent by other young women of similar age, who are in business offices, or stores, or at work of that kind, we come to the conclusion that the life of the ordinary high school girl is a very easy and very happy one."

I can speak perhaps more intelligently from experience as to the amount of work that is required in the elementary schools. It is only four years since I have been in the elementary schools of Brooklyn. I lived in the city some seven years before, and I confess I had the same opinion with regard to the work done in the elementary schools that is presented to you to-night. I had read in the newspapers letters that had been written, and of some special, individual case of a child having been treated in the manner described to you to-night. The account, being read widely throughout the city, would give the impression of general work of that kind in a school, but you, as scientific men know, and the first paper read this evening upon an entirely different subject than the subject of education, brought up the same principle—you as scientific men know how unsafe it is to pass any judgment upon so large a thing as the education of the children of this city by a few uninvestigated instances. The only way in which a subject of this kind can properly and scientifically be taken up is by some method of statistics by which you will have the entire number of children in any one school or any large group of schools examined, to see what per cent. of those children are suffering in their health from overwork.

Now I think the subject has been gone into very carefully by the gentlemen who represent the city in charge of our educational affairs, the Board of Education. Their rules are printed carefully, and every person who goes into the system as a teacher or principal is obliged to pass an examination on them, and they specify very plainly as to the amount of home work which can be given. No home work whatever can be given to the children in the primary department of the school, except a little supplementary reading and spelling, and if you could see the way the parents insist on having this home work given out, and begging that Jimmy or Johnnie be allowed to take his spelling book home, or some other book home, in order that the parent may follow the progress of that child and supply some rudiments of his own education, you would see how hard it is to resist the appeal of our patrons, and forbid the children having home work in the primary grades. When you get to the grammar grade where the children are nine years of age, and upward, the rules of home work permit only one-half an hour per day until you reach the age of about twelve years; then you are permitted to give out home work of about one hour per day. No mathematical calculations whatever are permitted to be sent home to be done, except in the last two grades. That is the last year of the work in the elementary school. I remember my first experience in the final examination of the elementary school. I came with those philanthropic ideas of preserving the health of my district, and I spoke very earnestly to the teachers in charge about avoiding mental strain. "Mental strain!" said they, "We cannot get up strain enough to get them to stick through the examinations. They don't worry over them. We cannot get them interested enough to have them look over their papers a second time to see whether they are wrong." Come up towards the close of February and look in at one of those rooms full of our boys and girls passing through those horrible grinding mills of ours, and see if you can discover that strain and that terror which has been mentioned. I cannot remember in all the four years I have been in this school a single case in the elementary school of trouble from overstudy or overwork, or from the devoting of too much time to the work. Most of our difficulty is on the directly opposite line of healthy, hearty boys and girls who are lazy; who have that good old-fashioned disease that did not use to be treated in such a scientific manner thirty years ago, the indisposition your father and my father would go at in an unsympathetic manner and cure. We have it. We have other things to contend with: an immense amount of outside interest that the parents encourage. When I was a boy I had to go to bed at the time when our youngsters are now out to dances and parties. We used to have those affairs in the afternoon if at all, but now you will find the children are out at night, and then follows the difficulty of getting the work done satisfactorily through the term. The inculcation of the habit of regular periodic work—the thing that is the greatest gain to any young man or young woman that can possibly be—is the thing that we are working for, and working hard for, and we cannot get it because we run against the physician's certificate telling the reason why the children should be excused. I should like to know whether the two gentlemen who have favored us to-night with the papers have really been in our public schools in Brooklyn, and have watched the work, because I cannot recall anything of that matter of "cramming," I cannot recall any of that failure to explain the subject; in fact, it seems to me our teachers talk too much and do too much explaining, and make things altogether too easy for the children. It is to be expected that my position would differ from that of the estimable gentlemen who have presented the interesting papers here this evening; but I am perfectly willing to leave to your judicial minds whether anything has been established. Before me sit half a dozen physicians who are members of the School Board. Why do these fail to be moved by the allegations? Perhaps it is because they have been in the schools themselves and are intimately familiar with their management. The Lord knows there are many imperfections in our public education, but I fail to see that they lie in the field exploited this evening. The point I submit to you is that the arrangement made here is not sufficiently established to carry weight. There are 141,901 children in school; they spend less than five per cent. of their time there between birth and graduation; the father, the mother, the neighbors and the doctors have them the rest of the time. Out of these 141,901 children, I have heard here to-night of five alleged cases of injury through the alleged fault of the schools. That would be about one three-hundredth of one per cent. of all the children in school. Now, honestly, gentlemen, though I have seemed to avoid a serious treatment of the theme, have I not given this minute fraction all the seriousness it deserves? If I should arraign the medical profession on such hearsay evidence for alleged failure in one three-hundredth of one per cent. of its cases, would you not laugh me out of the hall? I know that you regard it as reasonable that we should ask that you don't apply to school questions methods you would strenuously resent if applied to the estimation of the value of your service, but do study the schools as you study your own problems, by the exact method of observation, proof and quantitative analysis. No one will be more anxious to help you than the schoolmaster.

Dr. E. H. Bartley—The reader of the paper has dwelt upon certain phases of the subject, and very properly has brought out the effect of overwork, and the question of the general health of pupils in our crowded schools.

One thing that has frequently impressed itself upon me is the defects of the modern system in the teaching of the rudiments. I have for years observed in my classes, as well as in children attending the elementary schools, that those students who, for any reason, did not begin a new subject with the class suffered great inconvenience from this fact. When the student is thus handicapped he fails to understand what is said and becomes discouraged or irritated. The teacher becomes impressed with the idea that he or she is stupid, and this is soon felt by the student and adds to his embarrassment and to the nervous wear and tear. He dislikes the teacher, and thinks he is singled out for special disapprobation; he dislikes the subject because he cannot grasp it, and he frets and worries over it just in proportion as he is sensitive to criticism which he feels is unjust. It seems to me that this represents very fairly one of the most glaring defects in modern elementary education, viz.: The lack of sufficient drill upon the elements of what it is usually attempted to teach in the first three or four years. This is the direct result of trying to crowd too much into these first three or four years. The rudiments are thus slighted, and in after years no time is allowed the student to perfect himself in them, with the result that he is always floundering in the mire of his inability to properly cope with the subjects presented. In the mad rush of trying to crowd the pupil over an appalling array of a great variety of subjects, his whole education is superficial and unsatisfactory. He finds himself pushed into grammar school without knowing his alphabet. He is trying to master geometry without knowing the multiplication tables. He is taught to dabble in natural history before he is able to read or spell the ordinary words used in conversation. While object teaching is the correct and only method of teaching natural history, natural history has no place in the rudiments of elementary education, to the exclusion of or at the expense of the rudimentary subjects. The time so spent can be put to better use at this early age.

I have no sympathy with the introduction of natural science in the first three years of a child at school, to the exclusion of, or to the imperfect knowledge of, the multiplication tables. It is far better that habits of thoroughness and accuracy be taught, than that the child and parents be deluded with the idea that great results are accomplished by this veneer of outside matters. I have it from a member of the Examining Board of the Regents of the University of the State of New York, that applicants for a professional student's certificate frequently come before them who are unable to write a legible hand or spell the ordinary words used in everyday conversation. They cannot mark them on this because the Regents have no control over these subjects. However, he says, many of the applicants are very poorly prepared in this respect, but are sent to the professional schools with a certificate of fitness for any learned profession.

It is for these reasons that the higher schools are obliged to build a professional education upon a foundation often totally unfit to support it. Not long ago I examined eight students for the second year in chemistry. They were given a problem in arithmetic, involving the multiplication of decimal fraction by a whole number, and where the denomination used was a liter. Six of the eight failed to do it, either because the denomination was in liters instead of apples, or because they could not multiply a decimal fraction by a whole number. This is not an isolated case, but a common occurrence. The pupils in our elementary schools are not taught to be thorough, and these habits stick to them through life, unless in after years they are taught to be more thorough by some force of circumstances. They are not taught to think, but are taught to memorize a mass of collaterals, which are to be forgotten after the final examinations. Professor Gunnison says they are not even taught to memorize.

I firmly believe that the most of the overstrain of modern school life is a direct result of this continual rush through things that the student is not prepared for by previous training. Many of those who have the mind to think feel that education, so-called, is a waste of time, and they fret under the farce, and come to dislike school life, and all that goes with it. The boys beg to go to business, and the girls find any excuse to leave school. The aggravation and nervous irritation of this sense of unpreparedness, and of rushing over things they do not understand, wears and triturates the patience of both teacher and pupil, and lays the foundation for troubles which only those who remember their school days can realize.

I have heard students rather boastfully claim that they each year forget all they learned the previous year.

Dr. Heber N. Hoople—I cannot keep my seat and allow this subject to go by default. I think, as a profession represented here to-night, we owe it to the gentleman who has read the paper which we have heard opening this discussion, to show our appreciation of the character of that paper. I, for one, feel immensely indebted to the writer of that paper for the way in which he has taken up the systems of education that prevail and shown their deficiencies. I am very deeply impressed with the failure here to-night to appreciate the view point which Dr. Fairbairn has brought to bear on the subject except as it has been grasped by Dr. Bartley. It seems to me almost beyond belief that two representative principals should come here and fail to appreciate the view point which Dr. Fairbairn has brought before us; failed to see that there was anything at fault in our systems as they were being carried out at the present time by the teaching of the city, not to say anything about outside of the city. There is a subtle something that Dr. Fairbairn has touched upon that has not been appreciated by these gentlemen. It is either because they are in possession of something so very comfortable in the way of physical health themselves that they fail to see the defects in question, or they are actually out of touch with the pupils and with the teachers, and with the teaching which obtains to-day. Now I do not claim to be in touch with the teaching as they are supposed to be, but I do claim to feel the pulse which Dr. Fairbairn has shown us how to feel to-night, and I feel immense sympathy with the boy that he has given us, a picture of returning home day after day doing a useless task, accomplishing nothing in the process of education and really reaching no end adequate to the force put forth.

Now, what is at fault in our school system? There are many things at fault, but chiefly the one which the doctor has pointed out—this multiplying of subjects, so that none is mastered or grasped by the pupil. Underlying this, and beginning it right early in life is the fact which Herbert Spencer emphasized, and which has not been grasped by the educators of this time: That an early period of commencing educational processes is not to be recommended nor to be allowed. He says in his work on education, that the first seven years of a child's life should be devoted to making of him a good animal. The first seven years? It is a common thing in our schools in this city to find children of five, and under six entering upon the course of school work. They have not the physical stamina, especially the city children, to take up educational work at that period of life. If the first seven years were devoted to making good animals of them, then they could grasp with better firmness the tasks that are given them, even although they are primary tasks; and they would develop, as I have found every case to develop, much faster when the training began at seven years of age, than when it began at five. Invariably where that plan has been adopted the progress of the child has been better than when the child began his educational work at five or six.

Now, to carry on my criticisms still further, I would draw attention to this fact, which has seemed to escape the observation of Principal Gunnison, that even in our educational methods as they obtain to-day, the cart has been put before the horse, and development has gone on in impossible directions. Let me instance two specific cases: The study of grammar is begun in the seventh grammar grade, where the children are from nine to eleven, at the age when the exercise of the reason is very little developed. Grammar is an abstruse study. The consideration of abstract thoughts is not a matter which children of nine or eleven years of age will take hold of. One of the things that I recollect most distinctly, which was made mention of by Professor Bain in the examination of the mathematical papers of a large class of students sent to him, was this: That youth was not the period for abstract reasoning, and therefore, was not the period for success in the study of subjects calling for it. That principle applies to the study of grammar, which is one of those abstract subjects, and to commence that study at the seventh grammar and to continue it up to the first grammar grade is folly. To commence that subject in the first grammar grade when the children have reached fourteen or fifteen years is plenty early enough because the reasoning faculties have then begun to be developed, and they will develop from that time on.

Now, let me mention another point. It is a wrong in the system of education that the study of languages is entirely ignored by the common schools, except in the one particular instance of the study of English, and is relegated to the high schools and colleges. Now, in the natural course of things, the acquisition of languages is first, and nothing can the child do better than the acquisition of languages in the first years of its life. Nothing could be more satisfactory to the child's economic development than to have it spend, each day, an hour with the English teacher, an hour with the French, and an hour with the German, and, if you like to go a little further, an hour with the Italian teacher, and you have an acquisition of languages that would be very valuable. Later on, the acquisition of learning in abstract subjects would come naturally. But, the particular point I wish to emphasize as being valuable in Dr. Fairbairn's paper is the fact that many subjects are taught, and few are taught well. I would make as a motto of criticism on the system as it exists to-day, *"Non multa sed multum."*

Dr. Joseph H. Hunt—I have been very much interested in this discussion to-night. I think we have had a fair whack at each other on both sides of the question. I felt, however, a dozen years ago very much as my friends, Dr. Fairbairn and Dr. Bartley, feel to-night, that everything in school matters was wrong, and if we could only get a few doctors on the Board of Education things would go a good deal better, and I thought when I got on the School Board that I had a mission before me; I was going to work some reforms, and I began to study these questions of cramming and hurry, and overstudy and home work, and all that kind of thing. I found many things that I did not approve of entirely, but we are discussing the things that bear on the health of the pupils, and it seems to me that it is not our pupils who are suffering from overwork. I think the curriculum of study is very admirably arranged for a pupil of medium capacity. I am constantly seeing children of the same grade among my patrons who come home, as Mr. McAndrew said, and they do not have any home work to do, and other children of the same grade work for an hour or two, or even more, doing the same amount of work. That is a question somewhat of capacity or ability. That pupil may not get the proper grasp in school, or the vision may have been defective. That has been found to be one of the greatest sources of trouble, but by handing him over to the ophthalmologist, and fitting him with a proper pair of glasses, that child becomes a good pupil. Or, it may be the child does not get the proper amount of beefsteak at home, and is not properly nourished, and Dr. Bartley might examine his urine and tell what the trouble is, but that is not the whole question.

One of the things attacked to-night has been that question of physical culture. That certainly is overdone, but another man has said the children need motion. I go into the schools frequently. I often find the children upon the floor, and going through some little march or something of that kind. I asked a teacher why are they doing that, and she said they were getting dull, and she had thrown open the windows and given them a run around the room, showing she was a good, sensible teacher. There are others, of course, who follow the curriculum as laid down, that just this thing must be done at a certain hour. They belong to part of a machine. Then there is a difference in principals, also; if my friends will forgive me. One principal allows teachers and pupils a little latitude; with another principal, everything must be kept right up to a certain curriculum, and every one is kept on edge, the teacher and pupil, and possibly the principal himself, and I believe we see as a matter of experience as physicians more breaking down in the health of the teachers than we do of the pupils. The teachers have to do more home work than the pupils. From some schools there are numerous bundles of exercises, or essays or manuscripts brought home, and I see the teachers working sometimes two or three hours a night correcting papers and preparing certain schedules, and getting up their great books and things that Dr. Gunnison and Mr. McAndrew know more about than I do. There is more required of the teachers in home work, and outside work by far, than of the pupils. Our teachers not only have to teach, but there are these fads that come in. The physical culture teacher comes around, and she must see that that teacher puts all the pupils through what our recruits in the army call the "setting up exercise," and another comes around with her drawing, and the teacher has to become expert in that, and in painting and various other things in which the teacher has to attend lectures to become posted, and we see the teachers breaking down more than we do the pupils.

I personally feel very much obliged to Dr. Gunnison and Principal McAndrew for coming here and opening our eyes somewhat to the actual work of the schools.

Dr. Fairbairn—My argument ran thus:

(1) It is acknowledged by instructors that the amount of work required of pupils is very great.

(2) The increased demands are due to the greater ones on the part of public, college, and university.

(3) There is an attempt on the part of the pupil, in many cases, to discard the college training and to enter the technical or professional institution directly after the course in the secondary school. This requires condensation of work.

(4) While the demands on the pupil have increased, thorough teaching and training have suffered from lack of time and the great size of classes.

(5) The result of all this is seen in overstrain and defective intellectual development. There has been no attempt in the discussion to meet these statements. They have been evaded. It remains for me simply to reiterate what I have said, that there is an attempt at this present time to do too much in education and too little time is allowed for the work prescribed.

The statement by Dr. Gunnison that I describe methods which existed fifty years ago, is not according to fact. While the educator of the day maintains that the *reason* should be chiefly employed, he crowds his pupil to such an extent that that faculty is forced out of service and the *memory* drawn on in its place.

THE SCHOOL IN ITS EFFECT UPON THE HEALTH OF GIRLS.*

BY E. G. BRACKETT, M.D.,

Boston.

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When one sees a large number of children during the most important part of their lives, he is impressed with two facts: (1) The large number of girls who are weak, anemic and nervous, and (2) the very marked difference between the condition of the girls and that of the boys, when the procession reaches the developmental stage. At this point there are a large number of girls who are distinctly below par, who show evidences of distinct neuroses, and who are working dangerously near or beyond their fatigue limit. Of the children who apply to the hospitals in consequence of physical developmental defects hardly more than 5% are boys.

That this condition exists is a matter of observation, and to this is being given constant testimony by those who are continually being called upon to care for these conditions, occurring in so large a number of girls during this age. When we look for statistics concerning the health of children at this age we find indisputable ones taken from a large number of observations and carefully recorded. Hertel's investigation of 4,352 school children, found in 3,141 boys 31%, and in 1,211 girls 39%, who had chronic disorders. By commissions appointed in Sweden and Denmark it was found by one that of 17,595 boys 29%, and of 11,646 girls 41%, had chronic disorders. By the other it was found that of 11,210 boys 44%, and of 3,000 girls 61%, came under the same class. It is noteworthy—this report goes on to say—that one-half of the girls were chronically ill in their thirteenth year. Upon entering school 20% were chronically ill; but the curve of illness rises rapidly after entering, until in the eighth year 28% were ill.

Professor Key found that children who had less sleep than the normal amount (which he considered to be from ten to eleven hours for the young children, and eight to nine for the older) showed in the upper classes 5%, and in the lower classes 8%, more cases of illness than the other children. Out of 100,000 English school children, 8% suffered from nervous disorders of various kinds.

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* Read before the Boston Society for Medical Improvement, Dec. 16, 1901.

It is true that these statistics do not represent the actual condition here with us. They may not be paralleled by ours, but they do suggest grave questions in regard to conditions of child life, and in the minds of the medical profession naturally excite inquiry as to the causes which lead to them.

As a matter of experience and observation, we know that excessive mental exertion during the developing period interferes with the healthy and normal course of development. No special form of disease may show itself then, but the foundations may be laid and be manifested later. On physiological grounds we "know that an organism which does not receive the full share of development which was laid out for it by nature, and which it under favorable surroundings should have had, experiences during its lifetime a reduction of its achieving power and a lessening of its power to resist disease."

With these conditions, so frequently seen among our girls, of physical inability, abnormal development and mental exhaustion, with the accompanying distaste for work, and recognizing that the causes which are operative in them are excessive mental work, with the resulting development of one part of the organism at the expense of the other; failure to adapt the training to individuals; too little sleep, and too little play out of doors, the question then naturally arises as to the responsibility for this condition. Clearly it is divided between the home and the school. Many of the conditions are beyond the reach of the school, and the co-operation of the home should be expected to supplement the training in school life, which must play so large a part, and, therefore, the home should demand for itself a proportion of the time for that development which the school cannot and is not expected to supply. I refer to family duties, recreation and social associations, without which the child is a machine, and which need not demand an unreasonable amount of time. The household duties which, from necessity, some of the children are expected to perform, are not excessive except in some instances. From a large number of children taken from among the working class there was found an average of less than three hours per week to children between the ages of ten and sixteen.

Recognizing that the school does play an important part in the life of the child we may ask: What is the school demanding of the girl at the time when the physical claims are insistent, and cannot be disregarded without injuring her health and menacing her complete development; moreover, are the demands of the school consistent with a due amount of home life, or do they encroach upon the time which belongs to the parents for the training of their children.

The regular school session of five hours a day and five days a week is practically a constant standard, but the amount of outside work varies with the requirements of the various schools. In some of the older schools the figures vary from forty-four to fifty-two hours of required work per week. From two to fifteen hours per week, of outside work, was required of 124 school children of between the ages of ten and sixteen who were requiring attention for their physical condition. This made the minimum five and one-half, and the maximum eight, hours of mental work per day. The question of importance is, whether this amount of work is injurious to children, and particularly is it injurious to girls. The laws of Massachusetts have restricted the working hours of minors to about eight and one-half hours per day, as it deems that amount of physical work all that the developing child should be allowed to do.

Yet we know that the recovery from mental fatigue is much slower than that from physical, but we approach dangerously near or exceed this limit with the severer tasks of mental work, and it would be but natural to expect these long hours should show their effects.

Investigations also have shown that chronic disorders are especially frequent among children whose instruction extends over the whole day, and that the percentage of disease is greater among those who go to school all day than among those who go in the morning only. Hertel found that illness was 7% higher among children who worked excessively than among those who worked a usual amount.

It is a known fact that during the periods of accelerated growth there is a noticeable diminution in the power to resist fatigue, and the most important of these periods of growth—when the foundations of the health of the woman are being laid—occurs at a time when excessive demands are often made upon her mental powers. The girl needs an elastic consideration that is not necessary for the boy, for her more delicate nervous organization enables her to carry through an amount of work to a brilliant finish, leaving the results of this in her physique to manifest themselves later. Naturally the records of attendance and number of graduates do not show this most serious consequence.

We would not for a moment wish to underrate the importance nor the effects of the school, but at the same time there is the feature that must at times exert a far-reaching injurious influence, namely, that of its inelasticity. The conditions which are imposed on the whole should not be those which might with safety apply to the selected few, or to the most favored class, but to the average individual who is to make up later in life the bulk of the working force, and we must believe that the school is not accomplishing the most desirable and complete fulfilment of its highest purposes, if our educators do not recognize the necessity of making the training correspond to time and rate of development and growth of both the body and mind.

The school is responsible for much of the conditions found among our women in so far as its demands interfere with the usual and necessary amount of sleep and out-of-door play. It is responsible in so far as, by a competitive or ranking system, it increases, during the periods of accelerated growth, its demands on the mental powers, and in so far as it trains the mind at the expense of the body. It is responsible in so far as this system fails to recognize individual variations in the child, and especially between the boy and girl, and thus fails to adapt the training to the individual need; for not only is the method not adapted to girls as individuals, but not even to girls as a whole.

We can only turn to our educators with this condition which so frequently meets us, and ask if there is not some way by which the need of the individual may be provided for in our public schools.

THE HEALTH OF SCHOOL GIRLS.*

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So far as theoretical considerations bearing on overwork are concerned, there are certain well-known and well-accepted facts that must be considered.

During the periods of rapid growth, less mental work can be safely required of children than when growth is less rapid or has been finished. The size of the brain in its relation to body weight and to the other organs is much larger during the entire period of youth than at other times. It does not assume a constant relation to these organs until the eighteenth or twentieth year.

Certain physiological experiments upon the workings of children's brains must be considered because they have a direct bearing upon the question of the arrangement of studies and the examination question. It was found that there was an increase of 33% in the mistakes made by children in dictation tests given in the morning and after four or five hours of study and recitation.

In pupils from twelve to thirteen years of age, it was found in boys that in the third quarter of an hour of continuous work there began a marked deterioration in their ability to apply themselves to mental work. Taking five hours of interrupted work such as the ordinary school routine furnishes, it was found in a ten-minute test taken every succeeding hour, that the amount of work increases up to the third or fourth hour but diminishes in the fourth or fifth, and that the number of pupils making no mistakes decreases from the first to the fifth hour. The fact that the mental processes are impaired by continuous application in the third quarter of an hour of continuous work is too important to be set aside easily.

This bears directly on the question of examinations. Not only is the worry beforehand detrimental, but the stimulating effect of competition is undesirable apart from the well-established fact of mental exhaustion from continuous mental application. It is significant that Ignatieff found that 191 out of 242 children lost, on the average, three and one-half pounds during the examination period.

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* Read before the Boston Society for Medical Improvement, Dec. 16, 1902.

The relative endurance of boys and girls is of the greatest significance as bearing on the question. Christopher, in some work recently done in the Chicago schools, tested 5,636 children with the ergograph as to the conditions of fatigue. The ergograph is a machine in which a weight—7% of the pupil's weight—is rhythmically raised by the middle finger of one hand. By a recording drum the muscular contractions and their variation are recorded. Not only did he establish a definite daily curve of endurance diminishing toward noon but rising after the noon hour and diminishing again toward night, but he established the relative endurance of boys and girls. The endurance of girls beginning at five years old is slightly less than that of boys of the same age, but the curves remain parallel until about nine, when the girls' endurance diminishes somewhat in comparison to the boys'. At about fourteen a rapid change in the relation of the two takes place, and although the boys' endurance increases steadily till nineteen or twenty, the girls' endurance ceases to any extent from fifteen onward—a most significant fact.

These, to be sure, are theoretical considerations, but they show that children are easily fatigued by continuous mental effort, that frequent and long examinations must be detrimental, and that girls possess less endurance than boys, especially at, and after, the time of puberty.

These are only a few of the many facts accumulated by those who have studied the question. The practical point that concerns us is this: Are the pupils, and especially the girls in the Boston schools, overworked? Theoretical considerations may have their weight in the settlement of this question, but practical facts are needed so far as they may be obtained, and I have addressed myself to some of the teachers of physical training and other teachers in Boston and the neighborhood, as persons most likely to form an accurate opinion on this subject. I am largely indebted to them for whatever facts I may have accumulated. Any figures presented relate to the Boston schools.

In the school year ending March, 1901, there were in round numbers 82,000 pupils in the schools—4,400 in the kindergarten grade, 31,400 in the primary schools, 40,500 in the grammar schools, and only 5,600 in the high schools.

The percentage of pupils absent in each of these grades is interesting, but not, I think, of much significance so far as the question of overwork is concerned. The percentage of girls absent is always higher than that of boys.

	Average Absence. Boys.	Girls.
In the kindergarten............	22.7	26
Primary......................	11.2	13
Grammar.....................	7.4	9
High and normal..............	4.6	5.8

This means apparently that the further along the pupil gets, the more important his education appears in the eyes of his parents. In the primary and grammar grades there are more boys than girls, but in the high schools the girls outnumber the boys by 700.

I next investigated the question as to how many girls left school on account of ill health, and the figures deal wholly with the normal and high school grade. In three schools of this grade where figures were obtainable, 94 girls out of 1,938 left on account of ill health during the year. These are not all the pupils who leave, however. In one of these schools where 4% of the girls are put down as leaving on account of ill health, in the above list, the total number of girls leaving for all causes was 11%.

These figures are not, I believe, impressions, but are from fairly accurate records. Only 5,600 of 82,000 pupils are in the high schools. They represent a selected class who want a good education; their average daily absence is only 5%, as contrasted with 9% in the grammar grade. The fact that in this selected class one girl in twenty leaves school on account of ill health, is not to be overlooked. But if one waits for the ill effects of overwork to be demonstrated by the breaking down of the pupils, the harm has been done. It represents the end results. If we are to do good we must investigate overwork in its earlier grades.

The next question asked of the teachers was as follows: Do the girls, on the average, in your opinion, leave the school in better or in worse condition than that in which they entered? The answers of the teachers on this point differed widely. One class of seventy-six girls were questioned on this point at graduation. Thirty-nine had been improved, twenty-six had noted no change, eleven were not so well. One teacher replied: "I think the point to be made is not that the girls graduate in a worse physical condition than when they enter, but that they are not as much better and stronger as they should have been made during the critical years from fourteen to eighteen." There is no consensus of opinion that the girls are better when they leave. Some teachers were definite in their statement that they were not so well on the average.

As to the condition of the health in school, in only one school can any accurate record be given in the case of about 200 pupils.

Here the attendance was exceptionally regular, with an average absence of about two days per year for each pupil. Yet 30% had habitual headaches. Constipation, cold hands and feet, biliousness or indigestion were each present in from 5 to 15%. The average amount of home study was about four hours (it is thought by the teachers in many instances to exceed this), and the average amount of outdoor exercise sixty minutes. The trip to and from school is, as a rule, counted in this hour by the pupil. This school is, I fancy, not wholly representative, but presents the worse side of the condition.

Much of the so-called overwork, according to these teachers, lies in the home routine and outside duties—late hours, social or household demands, injudicious food, and the like. This is undoubtedly true, and it may be the sum total that is injurious rather than school work *per se*. But the remedy is none the less needed and the school should be corrective in its good effects rather than cumulative in its bad effect.

On one point the teachers of physical training and the other teachers are in accord. The remedy lies in a measure in the development of physical training in proper school gymnasiums under proper conditions. There is no dissenting voice among them and we must bend to their opinion. Exercises given in a poorly ventilated room between the desks amount to very little, but are good as far as they go. A proper gymnasium is important. They are all agreed as to the effect of one in improved health, better mental work, improved physical development, and several have insisted that such a routine induced better home conditions in many pupils. The high schools in Boston without gymnasiums are: The Girls' High (1,075 pupils) has a hall, the Girls' Latin (357 pupils) has a hall, the Boston Normal (9,214 pupils) has not even a special room. In these schools are about 1,650 pupils, mostly over thirteen years old, representing about half of the girls attending high schools in Boston without gymnasiums or proper facilities for gymnastic work, except such gain as may be got from free standing work in an empty hall not intended for the purpose. In no one of the grammar schools, containing 40,500 children, the bulk of whom are between nine and fourteen, is there a gymnasium. Two or three have a little apparatus in the corridor.

Whatever the merits of the school curriculum may be, we must pay attention to the opinion of these teachers as to the remedial effect of proper physical exercise in combatting the effects of overwork, if it exists. It seems to be the business of the medical profession to call attention to this, as the general community is not awake to the situation in any sense.

I have not dwelt on the evil effects of examinations, because there was so much to be said on the other question. The teachers are awake to it, and many are minimizing these bad effects. One teacher gives no marks on examinations except "passed" or "failed"; the anxiety to attain higher rank than one's neighbor has gone, and the girls have improved. At another school examinations are arranged so that no girl need take all her examinations during her menstruation. Many of the teachers are awake to the importance of short periods for examinations and long intervals between them. Yet, in a neighboring city, I am told, three-hour examinations are still given to grammar school children.

In short, the health of school girls about puberty seems to be far from what we would like to see it. It seems the result of school work plus outside demands. The school part should be corrective, and not an added burden. The development of proper gymnasiums and a sufficient importance given to physical training seems one important part of the remedy.

STATISTICS REGARDING THE HEALTH OF SCHOOL GIRLS.*

BY EDWARD MUSSEY HARTWELL, PH.D., M.D.,

Secretary Boston Statistics Department.

* Reprinted by permission from the *Boston Medical and Surgical Journal*, April 10, 1902.

I was invited to speak on the statistical aspects of the question under discussion, and more particularly with regard to the number of girls who leave school on account of ill health. I must acknowledge at once that so little scientific study has been devoted to the health of the school population of the United States, that statistics relating the effects of school life that are at once comprehensive and trustworthy are hardly to be found anywhere in this country. For the most part, the subject has been ignored. Broadly speaking, state and local boards of education render no account to the public of the number of school children who are temporarily or permanently incapacitated by disease, or of the number whose names are transferred from the school rolls to the register of deaths. The deaths of school children as such, at least in Massachusetts, are not required to be recorded by anyone.

It is useless, therefore, to attempt to determine accurately even the crude death-rate of Boston school children, not to speak of special death rates due to particular diseases. An approximate death-rate may be computed if we assume that the age period 5 to 15 years covers what is termed the school age. It must not be forgotten that it is an assumption, since there are some hundreds attending school who are under 5, and several thousands between 15 and 20 years of age;—the school census is taken annually to determine the number of persons in the age period, 5 to 15. Their number in 1900 was 90,144, of whom 77% were in public schools, 16% in private schools, and 7% not in school. In 1900 there were 483 deaths of persons of the age period 5 to 15. By dividing the total deaths of persons from 5 to 15 into three classes proportionate to the number of persons of that age period found in public and private schools and not at school, and computing the ratio of deaths to the thousand living in each class according to the school census, we find the following approximate death-rates: Pupils in public schools, 6.1 per thousand; in private schools, 5.5; children not in school, 9.4; persons 5 to 15 years of age, (1) including those not in school, 5.4; (2) excluding those not in school, 6.04 per thousand. These approximate death-rates cannot be taken as conclusive; still, they throw a little light upon our question, and suggest that the death-rate out of school is slightly lower than that of children in school. They throw no light whatever on the death-rate of persons between 15 and 20 years, which probably includes a relatively large proportion of the girls who suffer from over-pressure, if such exists. Sufficient data for computing the approximate death-rate of this class of persons in the city or in the schools cannot be had at present.

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* Read before the Boston Society for Medical Improvement, Dec. 16, 1901.

It does not appear that Boston's general and special death-rates compare very favorably with those of other great cities at home or abroad, though our general death-rate is lower than it was. Thus, the mortality per thousand inhabitants of all ages in Boston was 20.8 in 1900, against an average rate of 23.3 in the decade 1881 to 1890, in which decade Berlin had an average annual death-rate of 24.5, and London one of 19.1. In 1892 Boston and the London slums had identically the same death-rate, namely, 23.9.

The death-rate for the age period 5 to 15 is of special significance, as it is the decade of human life in which children grow fastest and death-rates are lowest. Six years ago I had occasion to show that Boston's average annual death-rate for the period 1885 to 1890 per thousand among persons from 5 to 15, namely, 6.6, was high in comparison with the Berlin rate of 4.8 and the London rate of 3.9 for the same 5 years. How it compares with such rates in London and Berlin to-day, I cannot say, but we may note with satisfaction that in Boston the death-rate for the year 1900 among persons 5 to 15 years of age, namely 5.4, was 1.2 per thousand less than the average for the years 1885 to 1890.

The death-rates of Boston school girls compare quite favorably with those of Boston school boys, as might be expected on general principles; but lack of time forbids my entering into any argument on the question in this connection. It is the fashion to disparage and criticise the public school system here and elsewhere, but those who aver that public school pupils are heavily and dangerously overburdened have not produced convincing evidence that it is so. In my opinion, neither the critics nor the defenders of the schools are in a position to enlighten the public on the matter, for the simple reason that no adequate investigation of the facts has been attempted hitherto.

So far as I can learn, the only states in which thoroughgoing scientific investigations of the effects of school life upon the school population have been made are Sweden and Denmark. The reports of the Swedish and Danish commissions, made more than ten years since, are most instructive, and abound in statistical tables. We have nothing to compare with them, and are not likely to have unless the medical profession shall bestir itself in ways it has not attempted as yet.

I have not been able to ascertain much that is new in reply to the question "How many girls leave the Boston public schools in the course of a year?" Many boys and girls do leave, but the reasons for their leaving (the number reported as going to work being left out of the account) cannot be stated accurately. In the *Monthly Bulletin of Statistics,* published by my department, there is a table which shows by classes of school, namely, high schools, grammar schools, etc., and by sex the total number of pupils belonging at the end of each month. Another table shows the number of employment certificates given to persons of school age by the school committee from month to month.

The school year begins in September and ends in June. I have made a table showing the number of boys and girls belonging at the end of the several months of the school year, from September, 1899, to June, 1901, 20 months in all—10 for the year 1899-1900, and 10 for the year 1900-1901. In each year the maximum number of girls in all schools fell in November, the third month; and the least number fell in June, the tenth or last month. The difference between maximum and minimum, which we may term "loss," amounted to 4.8% of the maximum in the first year, and to 5.1% in the second.

As regards all boys, their maximum was reached in November of the first, and October of the second, year, and their minimum fell in June in both years; the loss amounted to 4.9% of the maximum in the first year and 4.6% in the second. In the first year the loss among boys and girls was practically the same; in the second year that of the girls was slightly greater, namely, one-half of 1%. This does not suggest that girls as a class suffered overmuch.

As to the several classes of schools, the facts may be stated as follows:

(1) Kindergartens: Maximum enrollment in April, minimum in September, in both years, for girls and boys alike; difference between maximum and minimum, or loss, equalled 13.1% of the maximum in the first, and 13.9 in the second, year, for girls, against 11.9% the first, and 13.4 the second, year, for boys.

(2) Primary schools: Maximum in January, minimum in September for girls and boys alike, in the first year; second year, maximum in January, minimum in September, for girls, and for boys, maximum in April, minimum in September; the loss

equalled 4.8% of the maximum in the first, and 3.5 in the second, year, for girls, against 5.4% in the first, and 3.6 in the second, for boys.

(3) Grammar schools: For girls, maximum in October, minimum in June, first year; maximum in November, minimum in June, second year; for boys, maximum in October, minimum in June, first year; second year, maximum in January, minimum in June; the loss was 5.9% of the maximum in the first, and 5.7 the second, year, for girls, against 6.7 in the first, and 6.3 in the second, year, for boys.

(4) High and Latin schools: For boys and girls alike in both years the maximum enrollment fell in September and the minimum in June; the difference between the maximum and minimum equalled 20.1% of the maximum in the first, and 20.9 in the second, for girls, against 20.5 in the first, and 19.8 in the second, for boys.

(5) Normal school: Pupils all females, and mostly young women over 19, the maximum enrollment was in September and minimum in June in both years; the loss amounted to 28.8% of the maximum in the first, and 42.9 in the second, year. The increase of loss in the second year is explicable on the ground that the requirements for entrance and continuance in the school had been raised.

The proportional losses do not vary widely in the two years under review, and the figures I have given do not justify the supposition that a disproportionate number of girls are obliged to leave the Boston public schools because of impaired health. Excepting the normal school, which should be regarded as a technical or professional school, the largest annual losses, in any class of schools, are found in the high and Latin schools. There the losses are considerably larger than in the lower schools. If overpressure exists, they are the schools in which we should expect to find evidences of it.

If any class of public schools need to be investigated with a view to determining the effects of school life upon the health of girls or boys, that class is the class of high schools.

I venture to say that the medical profession is fully as responsible as the educational authorities for the present neglect of school hygiene and the undeveloped state of vital statistics relating to the school population. At the same time, the physicians are somewhat more fully alive than the teachers to the needs of the situation.

THE EFFECT OF PUBLIC SCHOOL EDUCATION UPON THE HEALTH OF THE COLLEGE GIRL.*

BY JANE KELLY SABINE, M.D.,

Boston.

Reprinted by permission from the *Boston Medical and Surgical Journal,* April 10, 1902.

Those who have preceded me in this discussion have pointed out the dangers to the health of growing girls in our public school education. We are now to consider the effect upon the college girl. She enters with the same neurotic tendencies that she acquired in school life. These may progress to such an extent that they culminate in a breakdown. On careful questioning by the physician, it will be found that the foundation of ill health was laid, in the majority of cases, during the age of puberty. Another may, by rigidly conforming to the rules of health, maintain such an equilibrium of her forces that she leaves the institution in much the same physical condition as when she entered. Still a third, who starts with delicate health, will gain during the added years of study, and go out into the world a stronger, more robust woman.

A medical adviser to-day who makes a physical examination of girls, when they come to college, broadly divides them into two groups—athletic and non-athletic.

It is ten years since Dr. Sargent had modeled a statue representing the typical American student—the 50% class. Were he to have one made of the same percental grade now, the proportions would have to be changed. The type would be better because of the influence of gymnastics and athletics in the lower schools. Bicycling, golf, and increased interest in all out-of-door sports have also done much to raise the standard. Nevertheless, the faults of the American standard would still be marked, namely, flat chest, hollow back, and prominent abdomen.

Observation of 2,000 students in finishing schools and college, gave the following tabulated results: 30% were either wearing glasses or ordered to have their eyes examined by a specialist; 6% showed defective hearing; 4% had flat foot; 5% had weak lungs; 4% had heart trouble; 2% had kidney lesions. Menstrual difficulties were most marked; 75% were found with irregularities dating from puberty; 60% had to give up from one-half to two days; and 90% had leucorrhea. Of those whose records were kept of four yearly examinations (up to the beginning of the senior year), 30% showed marked improvement, 30% were not influenced either way, while 40% were not improved.

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* Read before the Boston Society for Medical Improvement, Dec. 16, 1901.

Since these facts date to the time when menstruation first takes place, when habit neuroses are most easily formed, when morbid sensitiveness keeps the girl at work in school, the reconstruction in her education must be made in the preparatory schools. For whatever position in life she is to occupy, she needs good, sound health. Education at the expense of health is worthless. A sound mind in a sound body is priceless possession. The college girl should represent that type.

REPORTS FROM SOCIETIES.

PHYSICAL EDUCATION SOCIETY OF NEW YORK AND VICINITY.

The regular monthly meeting of the New York Society was held on January 18, 1902, Dr. Bissell in the chair and about one hundred members and friends present. This meeting was held in conjunction with the Physical Department of the West Side Branch Y. M. C. A.

Dr. W. G. Anderson gave a very interesting lecture on "Gymnastic echoes from England and Sweden", illustrated with one hundred lantern slides.

The February meeting was held in the same place. Dr. Thomas D. Wood, from the Teachers' College of Columbia University, New York, gave a fine address on the "Physical education of abnormal children." A general discussion followed, Dr. M. P. E. Groszmann leading.

The meeting closed with an informal tea and social which was much enjoyed.

At the March meeting Dr. J. W. Seaver presented a very interesting and instructive paper on "The periods of mental and physical growth in children". The informal talk which followed brought out many valuable points that physical educators generally would do well to observe, chiefly the danger of permitting young boys and girls to engage in competitive athletics at too early an age.

The following persons have been elected to membership during the past three months: Misses E. Edmunds, J. L. McBride, E. C. Mangam, M. F. Waite, J. L. Hanrahan, E. B. Bryant, E. M. Busler, B. K. Marsh, M. V. Andress, M. Jacobs, C. Harton, and Mrs. Lewis.

ALEX. E. WILSON BARKER, Secretary.

BOSTON PHYSICAL EDUCATION SOCIETY.

At the January meeting, one hundred and sixteen being present, the following resolution was passed, as recommended by the Local Outlook Committee:

WHEREAS, the Boston Physical Education Society believes that the children of this community need greater opportunity for physical education and development, and that this is best gained in connection with the public schools,

Resolved, that this Society requests the School Building Commission to provide sufficient and suitable playgrounds and gymnasiums in all the new school houses to be erected.

Five persons were elected to membership in the society, three of whom were already members of the A. A. P. E., one joining the same, and the fifth joining only the Boston Society.

Dr. Davis F. Lincoln read a paper on "Some observations of defective children", illustrating his remarks with stereopticon pictures. The discussion was by Dr. Walter E. Fernald, Superintendent Massachusetts School for the Feeble Minded; by Superintendent Seaver, of the Boston schools, who described the founding of the special classes for defective children now in operation in Boston; by Dr. Walter Channing; and by Dr. Sargent.

At the February meeting one new member was elected for both the general and the local society.

Dr. Theodore Hough read a paper on "Muscle soreness", giving the result of a number of experiments and deductions therefrom. The discussion was participated in by Drs. Fitz, Sargent, Skarstrom, and Meylan.

On March 13th the regular meeting was held, seventy-eight present. Four new members were elected for both societies.

A committee of five was appointed to co-operate with other organizations in a movement for increasing the number of classes for defective children.

The section of Medical Gymnastics, Dr. S. G. Webber, chairman, had charge of the program for this meeting, and presented Dr. Douglass Graham who spoke on "Massage and exercise in lateral curvature of the spine". The paper was discussed by Drs. Howard, Sargent, and Meylan, and Miss Nina Moses.

At the April meeting Dr. William W. Hastings read a paper on "The basis for the adaptation of various forms of exercise to public school children".

On April 26 the society gave a gymnastic exhibition. About one thousand persons were present.

At the meeting on May 8, Dr. Thomas M. Balliet, Superintendent of Public Schools, Springfield, Mass., spoke on "The play element in physical education". This was considered from the standpoint of the evolution of the nervous system of the child and its significance.

This meeting was the last for the season, the society adjourning to meet the second Thursday in October.

MARY REES MULLINER, Secretary.

REPORTS OF THE COUNCIL.

June 7, 1902—Present: Drs. Savage, Wallin, and Gulick, Mr. Bolin, Miss Beiderhase, Miss Bancroft.

The minutes of the previous meeting were read and approved.

The following persons were elected to membership: Eldora K. Richardson, Brooklyn; Rebecca Lesser, New York; Mary Vail Andress, Rutherford, N. J.; Marion N. Graham, Brookline, Mass.; C. C. Hallett, Boston; Elizabeth M. Fessenden, Detroit.

The following resignations were accepted: Lena D. Swinerton, Boston; Laura Fisher, Boston; Dr. Grace Wolcott, Boston; Mrs. E. A. Fletcher, New York; Albert Orton, New York; Mabel I. Otis, East Orange, N. J.; Delia M. Elliott, New York; I. C. Cheetham, Chicago; Mame J. Reiff, Kutztown, Pa.; Lieut. R. H. Sillman, Manila, P. I.; Robert Nohr, Milwaukee, Wis.

The following members were dropped from the rolls of the Association according to the requirements of the constitution: Mrs. E. B. Ayres, W. N. Golden, W. H. Mills, M.D., Robert Horn, Mary Goding, Prof. George K. Morris, D.D., E. B. Lund, M.D., Laura Goldsmith, A. A. Reed, M.D., Marion F. Hayes, Gus. Helbach, J. S. Helmer, John O. Norris, Sarah McA. Adams, John F. Bartel, M.D., Florence Breed, Irene E. Blake, E. L. Harris, A. G. Harvey, Ruth P. Hilliard, Hannah H. Janney, Eliza Kidd, Albert Dean Leonard, Mary A. Mahoney, Edith E. Minor, Jane Nye, Amelia L. Owen, Mary Preble, Carl L. Schrader, Elizabeth B. Barrows, Marguerite Barbour, Marion L. Earle, Frances Mitchell, L. J. McKells, M.D., Guido Werner, Margaret S. Wallace, F. B. Walker, P. M. Seixas.

The Secretary's report, including correspondence, was received and approved.

The Secretary reported that through the efforts of Dr. Gulick and the kindness of Mr. F. B. Pratt, storage room for the accumulated printed stock of the Association had been provided in the basement of the Pratt Institute Library, a fireproof building. A motion was unanimously passed extending to Mr. F. B. Pratt, and to Dr. Gulick, the thanks of the National Council for the use of this storage room.

The Secretary was instructed to communicate this resolution to Mr. Pratt.

The Treasurer's report, showing $43.55 on hand, was received and accepted.

The Chairman of the Finance Committee reported progress in securing advertisements for the Review.

The Editor of the Review reported progress.

The President reported that he had been unable to secure anything definite from local societies with regard to holding the next National Convention. The Council left a decision as to the place of the Convention in the hands of the President and Secretary, with a preference for Michigan as the place of meeting and Philadelphia as a second choice.

The Council adjourned to meet at the call of the Secretary.

JESSIE H. BANCROFT, Secretary.

OFFICIAL ANNOUNCEMENTS.

MEMBERSHIP DUES FOR 1903.

The membership dues in the A. A. A. P. E. for 1903 ($2.00) are payable in advance on January 1st, and should be sent to the Secretary, Jessie H. Bancroft, 80 Joralemon Street, Brooklyn, N. Y. This applies to members of local societies who are also members of the national association, as well as to members at large.

This payment will entitle a member to The Physical Education Review for 1903. Beginning with the number for March, 1903, the Review will be sent only to such members as have paid dues for the current year.

After January 1, 1903, the National Council will not consider any application for membership in the association that is not made upon the official blank (which will be furnished upon application to the Secretary) and accompanied by the annual membership fee of $2.00.

Applications for membership in the A. A. A. P. E. from members of a local society must be endorsed by such society through one of its officers.

Membership shall be for the calendar year, dating from January 1 to December 31 of the year designated on the blank by the applicant.

Members elected during the year will receive all back numbers of the Review for that year.

Any member whose dues are two years in arrears will be dropped from the rolls of the association.

CONVENTION PROGRAM.

The next national convention of the American Association for the Advancement of Physical Education will be under the auspices of the Southern Michigan Physical Education Society, of which the officers are Mr. Wilbur P. Bowen, Ann Arbor, President; Dr. Alice G. Snyder, Ann Arbor, First Vice-President; Mr. M. B. Seiffert, Detroit, Second Vice-President; Mrs. Fannie Cheever Burton, Ypsilanti, Secretary; Miss Pamelia Clough, Detroit, Treasurer. A general outline of the program follows:

Monday evening, April 6, Detroit, reception.
Tuesday, April 7th, forenoon, Detroit Eastern High School.
    Address of welcome and response.
    President's address.
    Business.

Tuesday afternoon, general session; papers.

Tuesday evening, general session; addresses.

Wednesday, April 8th, take cars at 8.30 A.M. for Ann Arbor.

10.15 to 11.45, stop at the Michigan Normal College at Ypsilanti and attend exhibit of practical work in the gymnasium, under the direction of Mrs. Fannie Cheever Burton.

Wednesday afternoon, University Campus, Ann Arbor.

Section meetings.

5 to 6 P.M., informal reception and tea, parlors of the Women's Gymnasium.

Wednesday evening, Women's Gymnasium, University of Michigan.

Exhibition of practical work by men and women of the university, the former under the direction of Director Fitzpatrick and Dr. May, and the latter under the direction of Dr. Alice G. Snyder. Return to Detroit Wednesday evening.

Thursday, April 9th, forenoon, Detroit Eastern High School.

General session; papers.

Thursday afternoon, business meeting.

Thursday evening, Opera House.

Exhibition of practical work by pupils of the Detroit schools and the various gymnastic societies of the city.

Speakers and papers will be announced later.

EDITORIAL NOTE AND COMMENT.

The following comes from the Secretary of the N. E. A.:

"The Executive Committee of the National Educational Association authorizes me to announce the selection of Boston as the place of meeting in annual convention July 6-10, inclusive, 1903.

"The railway lines of the New England Passenger Association have granted the usual rates and ticket conditions, viz., one fare for the round trip plus the membership fee, with provision for extension of tickets upon the deposit plan until September 1st.

"IRWIN SHEPARD, Secretary."

ABSTRACTS.

The Effect of Regents' Examination upon Nervous Children.—DeWitt C. Wilcox, M. D., calls attention (*The Homœopathic Journal of Pediatrics,* March) to the effect of the regents' examinations in New York State upon nervous children. The article was read before the New York State Homœopathic Medical Society, February 11, 1902, and it is an extremely valuable contribution at the present time, when the stress of advanced educational methods has placed such additional burdens upon our children in the public schools. He says that but few observing parents in New York State have failed to notice at the time of an approaching regents' examination symptoms of nervous, apprehensive excitement, irritability, loss of appetite, or sleeplessness in those children who were preparing for such examination. After the regents' examination has occurred, there can often be observed evidences of physical exhaustion, nervous exhilaration or depression, hysterical emotions, and, in some cases, absolute collapse. Furthermore, the author believes that physicians are called to attend more children for actual illness immediately after the regents' examinations than at any other time of the year, seasons of epidemic alone excepted. He considers that in nearly every nervous child the mental excitement and nerve tension of the examinations so exhausts the reserve force, always slender in these children, that resistance to disease becomes lessened, leaving the child subject to almost any malady that is prevalent, whether catarrhal cold, typhoid, scarlet fever, or any other disease. He suggests that epidemics of the various exanthemata which occur about the time of the regents' examinations, may do so because natural immunity is destroyed by the lowered state of vitality. These semi-yearly examinations occurring in the younger school life of sensitive children are, in the author's opinion, the main cause of nervous collapse exhibited in late life by college students, the hard study at college being merely the climax of the strain begun in earlier years. The author instances three little patients of his own to illustrate the statements he has made, and goes on to say, apropos of the regents, that no system, no matter how apparently useful for the advancement of the child's education, should be tolerated, which, in its operation, causes a lowering of the physical stamina of the developing child. He concludes with the following forcible paragraph:

"We made a great step forward when athletics became a part of college education, but we have much to do yet amongst the small school children who are in the most plastic state of physical and mental development, and who, if injured while at that tender age, rarely recover the lost stamina or physical vigor. There is much that requires correction in the physical school life of the young, in order that the children may attain to perfect physical manhood and womanhood; but the one particular error which I am convinced this State is making toward its younger pupils—and I speak specifically of children between the ages of eleven and fifteen years, that very infantile and captive age of puberty—is the subjection of such children to a twice yearly ordeal which is of questionable benefit mentally, and, to my mind, is one of the greatest factors in the production of nervous irritation and physical ailments to which the school child is subject."

M. P. G.

Effect of Muscular Work Upon Digestion and Metabolism.—Prof. Charles E. Wait, of the University of Tennessee, has contributed in Bulletins 89 and 117 of the Experiment Station of the U. S. Department of Agriculture the results of an extended series of investigations into the effect of muscular work upon the digestibility of food and the metabolism of nitrogen. The composition of food and feces was determined to obtain evidence upon the former point, and the income and outgo of nitrogen to settle the latter. The conclusions drawn are that the "digestibility of the diet was uninfluenced by muscular work," and that "no constant difference was observed in the amount of nitrogen excreted in the urine in different periods (work and rest) which could be attributed to the muscular work performed."

With regard to the first of these conclusions, too great caution cannot be observed in giving them general application. When it is found that the digestibility of the food remained the same in three series of experiments of four days each, the first and third being a "rest" experiment, the second a "work" experiment, we are only justified in concluding that muscular work on the diet in question had no *immediate* influence on the digestibility of food. The experience of mankind hardly leaves room for doubt that reasonable muscular work has a marked influence in the long run on the digestibility of food.

As to the work of Professor Wait on nitrogenous metabolism, it is somewhat difficult for the physiologist to see the value of the results, since it is perfectly well established by numerous researches, both upon man and the lower animals, that, with a sufficient mixed diet, muscular work is practically without effect on the amount of nitrogen excreted. No one doubts this, so far as we are aware. The classical experiments of Voit, of Fick and Wislicenus, of Parkes, and of the many other investigators who have gone over the same ground, with more refined methods of chemical analysis and satisfactory control of the physiological conditions, have amply established the fact. Even Pflueger, who believes that all muscular work must be done at the immediate cost of decomposition of the nitrogenous "living molecule," admits that the nitrogen of this molecule does not appear in the urine, and holds that it is recombined with non-nitrogenous foods to again form a "living molecule." In the light of these and similar facts, we cannot but regard further investigation of this subject as useless.

T. H.

The Normal Position of the Big Toe (Joseph Griffiths, M.A., M.D., F.R.C.S., in the *Journal of Anatomy and Physiology,* July, 1902).—The writer begins by saying that the usual description of the normal position, viz., continuous with a straight line drawn from the inner side of the heel to the inner side of the joint of the big toe, is contrary to fact. The range of lateral movement is about 20° and the normal position is midway between abduction and adduction, the three bones of the toe following a gentle curve outward most marked toward the end. This outward deviation is found at birth before there could be any influence from footwear. In the examination of eight Greek statues he found a deviation outward averaging about 10°, which is very near that of the average modern foot. His conclusions are that in the newly born, in the adult, in the savage, in the ancient Egyptians, and in the modern civilized man the characteristics are the same, a deviation from the straight line of from 10° to 20°. The writer offers in explanation the theory that this outturning of the great toe gives it a mechanical advantage in weight bearing and in giving an impetus to the body in walking because it puts the power more nearly opposite the middle of the weight-bearing surface.

R. T. M.

BOOK NOTICES AND BIBLIOGRAPHY.

ONE HUNDRED AND FIFTY GYMNASTIC GAMES, by Members of the Alumni of the Boston Normal School of Gymnastics. 1902.

This is a revised and enlarged edition of the book previously published under the title of "One Hundred Gymnastic Games." Some of the additions are familiar games, but a number are new and show much ingenuity. The games are classified as "Ball Games" (a division which includes games with bean bags), "Running Games," and "Miscellaneous and Quiet Games." Games suitable for the school room are indicated throughout, and also the age of pupils for which each is appropriate. An alphabetical index adds to the convenience of the volume. The directions are very clearly and concisely written and the educational value of particular games is occasionally pointed out. The tone of the entire book is dignified and educational—a welcome treatment of the subject. There is room for a difference of opinion as to the paradox in the title, *Gymnastic Games.* The book cannot fail to be of great practical value to anyone using games in the gymnasium, playground, parlor, or school room. J. H. B.

GAMES AND SPORTS OF JAPANESE CHILDREN, by Mr. Tominaga, Tokyo, Japan.

In view of the comparatively recent awakening in our own country to the educational value of children's games, it is somewhat surprising to receive from the Orient an illustrated volume on this subject. Our correspondent writes, however, that nowhere in America has he seen so much attention given by teachers to the playground games of pupils as in Japan.

Each game is carefully described, many of them illustrated. Hints are given calculated to aid the teacher in perceiving the educational value of the games and in studying children. The games are suitable for the playground and gymnasium. There are many novel features in them suggestive of their origin. For instance, in a book that begins at the back cover and reads forward, it is not surprising to see described a race backward on all fours. There are combinations of peculiar skill, and what one might call elementary juggling, with more usual game features. The element of competition is very strongly in evidence and there are numerous variations upon the relay idea. It is to be hoped that an edition of this book may be published in English, as it would undoubtedly contribute some valuable features to our store of games. J. H. B.

INDOOR AND OUTDOOR GYMNASTIC GAMES, compiled by A. M. Chesley, with an introduction by Luther Gulick, M.D. Spalding's Athletic Library, July, 1902. Price ten cents.

This collection of games is especially designed for male adolescents. One finds in its pages many old friends, and some games not so well known. The section on Athletic Feats is a good one. All of the games and sports here described have been well tried, and attest throughout, especially in the introductory pages, the scientific spirit which has raised games and sports to a recognized place among educational methods. J. H. B.

RATIONAL PHYSICAL CULTURE FROM THE STANDPOINT OF THE PHYSICIAN, by Constantine McGuire, A.M., M.D., with preface by John Crego Lester, A.M., M.D. Printed by Eagle Printing Department, Brooklyn.

CLASSIFIED INDIAN CLUB EXERCISES, by A. K. Jones. Published by the author, Nashville, Tenn. Pp. 68.

THE PHYSIOLOGICAL EFFECTS OF BICYCLE RIDING.—Prof. Paul Schiefferdecker has contributed in his *Indikationen und Contra indikationen des Radfahrens* (Leipzig, S. Hirzel, 1901, pp. 83) a most practical and useful discussion of the physiological effects of cycling, and of its use in various pathological conditions. The work is of more general interest than the limited scope of its title would indicate, since the discussion involves to a large extent the physiology of muscular exercise in general, and is a remarkably clear and accurate statement of many sides of this subject, so inadequately treated in most of our text-books. T. H.

MONATSSCHRIFT FÜR DAS TURNWESEN. Berlin, 1901. Vol. XX.

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No. 3 (March). The Work of the German Turnlehrerverein, as Exhibited in the Annual Reports from Branch Societies (concluded in No. 5). Reply to A. Hermann's Article (see December No.) on Gymnastic Terminology, by Alfred Maul. A Criticism of Gymnastics in the Schools. Explanatory Remarks with regard to Maul's Plan and Method of Gymnastic Instruction, by Dr. Sickinger (continued in Nos. 4 and 6). A Report on the Condition of School Gymnastics in Baden. Report of the Berlin Turnlehreverein for the Year 1900-1901 (concluded in No. 4). Other Annual Reports.

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ROUND SHOULDERS AND FAULTY ATTITUDE: A METHOD OF OBSERVATION AND RECORD, WITH CONCLUSIONS AS TO TREATMENT.*

ROBERT W. LOVETT, M.D.
Boston.

The present paper is intended to call attention to a simple and fairly accurate method of observing and recording faulty attitude in standing. This matter is of importance because the type of faulty attitude known as round shoulders, for instance, is not a local, but a general disturbance of the anteroposterior balance, involving pelvis, legs, and feet as well as the spine. Former observations have been concerned mostly with the spinal curve alone, but to appreciate the affection properly the base of support must also be considered. This method of record throws a certain practical light upon the question of treatment.

Method of measurement.—Measurements are taken from a perpendicular plane behind the body, the distance of certain easily recognized bony landmarks being taken. The measurement aims to give a side elevation of certain points in the skeleton.

The method has been in use two years, and the material at my command consists of seventy-two observations made on normal boys between the ages of fifteen and nineteen years, by Dr. A. M. Greenwood, to whom I am indebted for much assistance in all my observations; of some six hundred observations on young women, made by the physical director of one of the women's colleges; of a hundred or more observations made by the writer and some assistants in the scoliosis clinic of the second surgical service of the Children's Hospital; and on a series of about the same number made on cases of faulty attitude in private practice. Cases of marked scoliosis have not been taken into account in the following analysis, as they seemed to form a separate problem of much importance, to be taken up after more information was obtained about the normal attitude and the common anteroposterior variations.

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* Read before the American Orthopedic Association, at Philadelphia, June 5, 1902.

(Reprinted by permission from *The Boston Medical and Surgical Journal*, November 6, 1902.)

The apparatus by which the measurements are taken consists of the ordinary wooden upright with a sliding arm used for measuring the height. On this sliding arm and at right-angles to it is a horizontal arm eighteen inches long, which is placed at six inches from the back surface of the upright rod. This back surface of the upright rod is taken as the perpendicular plane from which distances are to be noted, and the measurements are made from the sliding horizontal arm, which is always six inches distant from the back surface of the upright (Fig. 1). Any point, therefore, more than six inches from the sliding horizontal arm is in front of the perpendicular plane agreed on, and any point less than six inches is behind it.

The middle of the external malleolus was taken as the lower end of the perpendicular plane from which measurements were to be made. The patient stands without boots, in a natural position, with the feet forming an angle of 45°, and with the middle of one malleolus opposite the back surface of the upright, the back of the patient, of course, being toward the sliding horizontal arm.

The measurements of the bony landmarks to be mentioned are then taken from the sliding horizontal arm, and the height at which each measurement is taken is recorded. This may be done, of course, either in inches or centimeters. Having then the height of each point desired as well as its distance from the ground, it is a simple matter to reproduce graphically the relation of these points by using ordinary co-ordinate paper and allowing one inch or one centimeter to each space on the paper. To secure uniformity of results, it may be assumed that the patient is seen facing to the left.

The landmarks taken for measurement were those which could be easily identified by touch. They are as follows from above downward: (1) The middle of the mastoid process; (2) the spine of the vertebra prominens; (3) the spine of the seventh dorsal vertebra (on a level with the inferior angle of the scapula); (4) the spine of the fourth lumbar vertebra (on a level with the top of the iliac crest); (5) the middle of the great trochanter; (6) the middle of the head of the fibula; (7) the middle of the external malleolus.

The measurement is taken by marking with a skin pencil the points to be measured. The patient is then placed with the back to the sliding arm and the outer malleoli opposite the back edge of the upright. In order to get the measurements before the patient becomes fatigued and sways, it is necessary to work quickly. The mastoid measure is taken, and then the arm pushed rapidly down while the distances of the points from the upright are measured with a rule at each level. Having taken these down, it is necessary, if the curve is to be reproduced graphically, to record the height from the ground of each bony landmark, and

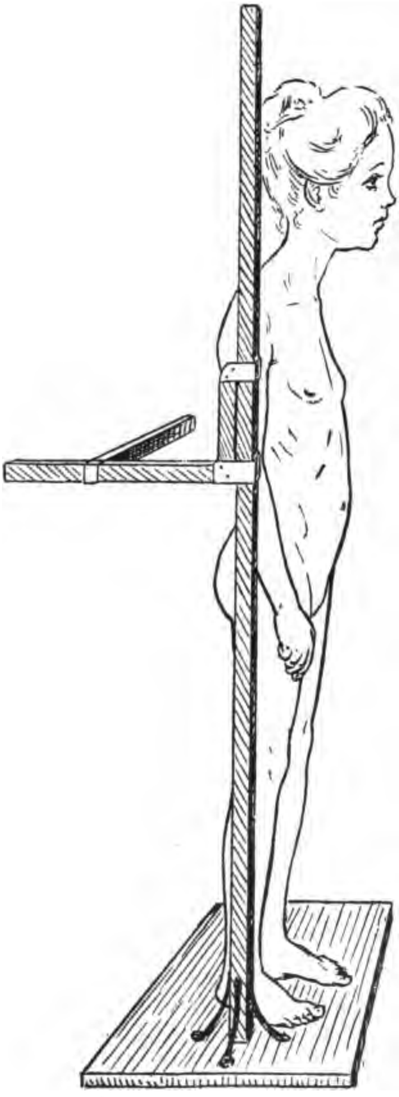


FIG. 1.—Apparatus for measuring variations in attitude.

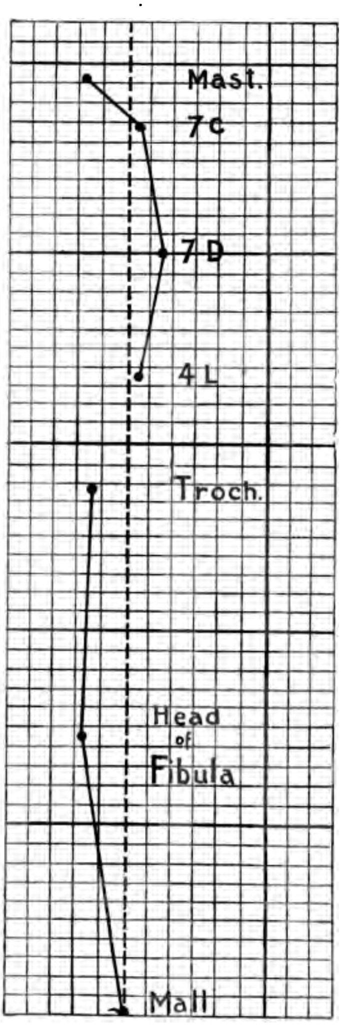


FIG. 2.—Graphic representation of standing position. Case M. L.

the sliding arm is again pushed up and the level of each marked bony landmark recorded. By this division of the two measures the first and important one should be finished before the patient becomes unsteady, and in the second set swaying is of no account.

A typical measurement would be as follows:

Case M. L. Type *a*. (Fig. 2.)

	Distance from upright.		Height.
Mastoid	7¾ inches		49 inches.
Seventh cervical	5½ “		46½ “
Seventh dorsal	4½ “		40 “
Fourth lumbar	5¼ “		33½ “
Trochanter	7¼ “		27¾ “
Head of fibula	7¾ “		14½ “
Malleolus	6 “	assumed to be...	0 “

The curve is plotted by marking the points on co-ordinate paper and drawing lines between them (Fig. 2). As below the level of the fourth lumbar vertebra the line no longer follows the back outline of the body, but changes to the axis of the leg, the fourth lumbar and trochanter marks are not connected by a line.

Certain criticisms may be anticipated and answered in advance.

With regard to the general accuracy of the method, it has been repeatedly tested by taking two successive independent measurements of the same patient and comparing them, and by taking measurements on succeeding days and comparing them, with the result of finding that the two conformed on the whole, the type persisting and the chief difference being in slight swaying forward or back which was at times evident.

Measurements of the same patient taken by different persons with fair experience in the method have shown similar curves, with slight swaying forward or back, evident at times.

The method is not intended to be mathematically accurate, but to give a fairly accurate graphic representation of the patient's method of standing. It has the advantage of being applicable in adults, where record by full-length photographs is not available, and the measurements can obviously be taken without objectionable exposure in the case of women.

Before proceeding to consider the practical bearing of the results yielded by the method it may be said that the common type of faulty attitude, the one known as "round shoulders," has received very scant attention in American and English textbooks on orthopedic surgery, and in a careful search through the orthopedic surgeries of Jackson Clarke, Keetley, Tubby, Reeves, Bradford and Lovett, McCurdy, Moore, Sayre, Whitman, and Young, only vague and general descriptions of the affection were to be found.

In the *Transactions of the Orthopedic Association* there have been a few articles dealing with the subject. In Vol. I is an article by Stillman discussing in general terms backward yielding of the spine. In Vol. X, Bradford called attention to the contraction of the pectoral muscles in this condition, and spoke of the effect of supporting-straps over the shoulders, which hold the weight of the clothes, in causing it. In Vol. X is a paper by the writer on the relation of round shoulders to fatigue, and on the association of pronated foot and faulty attitude. Brackett read a paper dealing with the varieties of faulty attitudes, with some classifications of deviations from the normal, before the Boston Physical Education Society in 1901. There are a few articles dealing with the subject of braces in round shoulders. These are all the articles in English which it has been easy to find.

In German, on the other hand, are numerous articles dealing not only with the normal attitude in standing, but with variations from the normal. But here there is but little agreement as to what the normal attitude is. The chief article dealing with the variations from the normal is by Staffel.[1] The other main articles on the subject are by the Brothers Weber[2] and the following: Boegle,[3] Parou,[4] Henke,[5] Froriep,[6] Langer and H. Meyer.[7]

In such books on orthopedic surgery as those of Hoffa, Rédard, and Lüning and Schulthess are found abstracts from the above work, with the individual views of each author as to which of them is nearest to the truth as to the proper normal attitude.

In regard to variations from the normal as seen in faulty attitude there is, however, general agreement as to types, the classification of Staffel being on the whole followed.

Combe, who has recently examined 2,314 school children at Lausanne, divided abnormalities into (1) flat back; (2) round back; (3) lordosis; (4) kypholordosis—a classification practically the same as Staffel's. Schulthess uses a classification much like this, with different and more complex names. Rédard recognizes only kyphosis and lordosis. Hoffa follows Staffel.

The difficulty with the classifications of faulty attitudes seems to be that the anteroposterior outline of the spine alone has been chiefly considered and but little or no attention has been paid to the relation of the feet, legs and pelvis to the spine and of the whole body to the perpendicular. And again no uniform system of measurement has been in use. Under these conditions have been only parts of the problem formulated. The general attitude is likely to be imperfectly represented by any drawing or observation made of the spine alone, because it is obvious that a backward curve of the upper part of the spine cannot occur without disturbing the normal relation of all the supporting structures below it. Equilibrium must be maintained, and the necessary adjustment involves feet, legs and pelvis in their relation to the spine and to the perpendicular.

---

[1] Franz Staffel: Die menschl. Haltungstypen, etc. Wiesbaden, 1889.

[2] Mechanik der mensch. Gehwerkzeuge.

[3] Boegle: Ueber den Mech. des mensch. Ganges, 1885.

[4] Parou: Virchow's Arch., 1864, xxxi, 1-2.

[5] Henke: Anat. u. Mech. der Gelenke, p. 213.

[6] Froriep: Anat. f. Künstler. Leipzig, 1880, p. 40.

[7] Langer and H. Meyer: Anat. der äusseren Formen d. mensch. Körpers.

The practical points to be developed by a study of the results of such a system of measurement as that described should be as follows:

(1) What is the normal type of standing position in well-balanced individuals?

(2) What are the variations from this type in faulty attitude?

(3) What is the essential factor in producing faulty attitude? Is it to be found in spinal weakness, in an abnormal position of the pelvis, or in an improper base of support?

(4) What should be the general scheme of treatment?

(5) Can the results of treatment be formulated and what change in attitude do they show?

Some of these questions can in a large measure be answered by the material already collected, while others cannot be.

(1) *The normal attitude* has been investigated and formulated in diagrammatic figures by many writers. These figures differ from each other, as would have been expected, not only because there has been no satisfactory system of measurement, but because the normal type of standing must be modified by age, sex, race, fashion and occupation. A military cadet would not be likely to assume the same standing attitude as a woman of the same age who had worn tight clothes, heavy skirts and pointed boots for five years. Still, approaching the problem as one capable of general solution, in the same way as considered by Meyer, Langer, Henke, Staffel and others, the following facts are available:

The measurements of seventy-two boys taken by Dr. Greenwood seem the material most available to compare with the results of the writers mentioned. They were all healthy, well-developed boys, averaging eighteen years of age, and the individual tracings differed but little from each other. An average curve of the tracings is, therefore, representative of the standing position of these young men (Fig. 3).

Tracings of the curves of the normal attitudes as represented by v. Meyer, Langer and Staffel were then taken by marking on their figures the places of the bony landmarks adopted, connecting them with lines and considering them in their relation to a perpendicular erected through the external malleolus in each case. The normal of v. Meyer reproduced in that way was unlike any

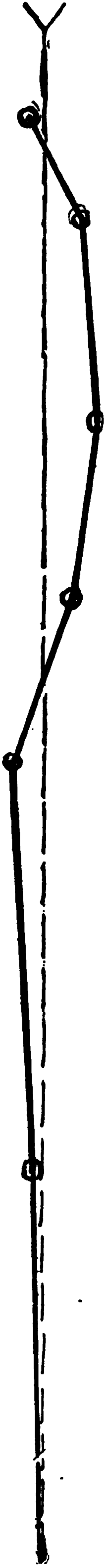


FIG. 3.—Average curve of 72 boys (Greenwood).

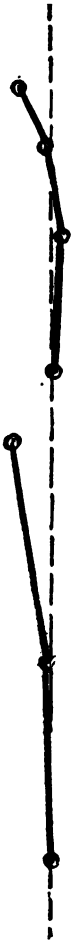


FIG. 4. v. Meyer's Normal.

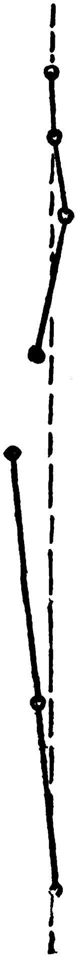


FIG. 5. Langer's Normal.

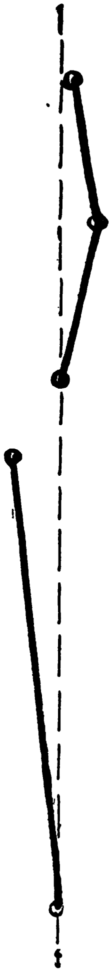


FIG. 6. Staffel's Normal.

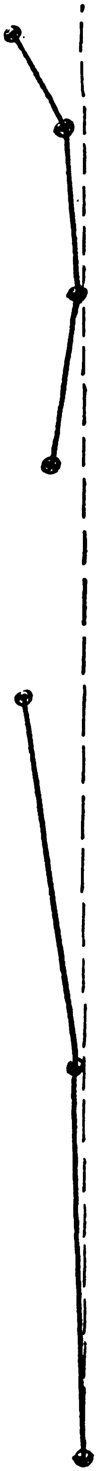


FIG. 7. Curve of young adult female of

curve found in normal persons (Fig. 4), while that of Langer is also unusual (Fig. 5). The normal curve constructed from Staffel's figure (Fig. 6) is, however, practically identical with that of the seventy-two boys.

With regard to the curves of the six hundred college girls it has not been possible as yet to analyze them in detail. The individual variations are much greater than in the males, and there is a general tendency to carry the body further forward and to hyperextend the knees, the lumbar curve, also, as one would expect, being greater than in the males. Fig. 7 is a fairly representative curve of the women of the best apparent physique and carriage.

(2) *Types of variation in faulty attitude.*—As no one classification of these types has been universally adopted, and as the classifications differ among themselves, it seemed best to start afresh and see if these measurements of patients (mostly children) offered any basis of reasonable classification by which they might be divided into groups for study, to see what constant types of variation the curves showed, and to find out by photographs to what clinical types of faulty attitude these variations corresponded.

It was difficult to decide what factor in the attitude should be the basis for classification; whether it should be the relation of the trunk to the legs, of the pelvis to the perpendicular, of the whole swing of the body backward or forward, or of the relation of the points in the spine itself. On examining the graphic representations of the tracings of faulty attitude in this connection the most constant grouping seemed to be by the spinal curve. That is, the cases showed four types of spinal curves, and, arranged according to these types, the other characteristics of the curves seemed to be fairly constant in each group. It is not by any means sure that this classification is founded on the best basis or is of any value as it stands. It is simply presented to show that the essentials of the patient's attitude may be studied, and a proper and accurate classification reached in time.

The four types of spinal curve were as follows:

TYPE A (Fig. 8). A general curve (an exaggeration of the normal lines), where the spine from the mastoid to the fourth lumbar forms one general curve backward. As a rule there is little lordosis in these cases (as shown by the relation of the fourth lumbar to the trochanter). The pelvis is, as a rule, well in front of the perpendicular, and the body axis lies generally in the perpendicular, but may be wholly in front of it, and in one case only lay behind it. The legs, as a rule, incline forward and are rarely hyperextended at the knee. This is the most frequent type, and consists, in a word, of rounded back with little forward lumbar curve.

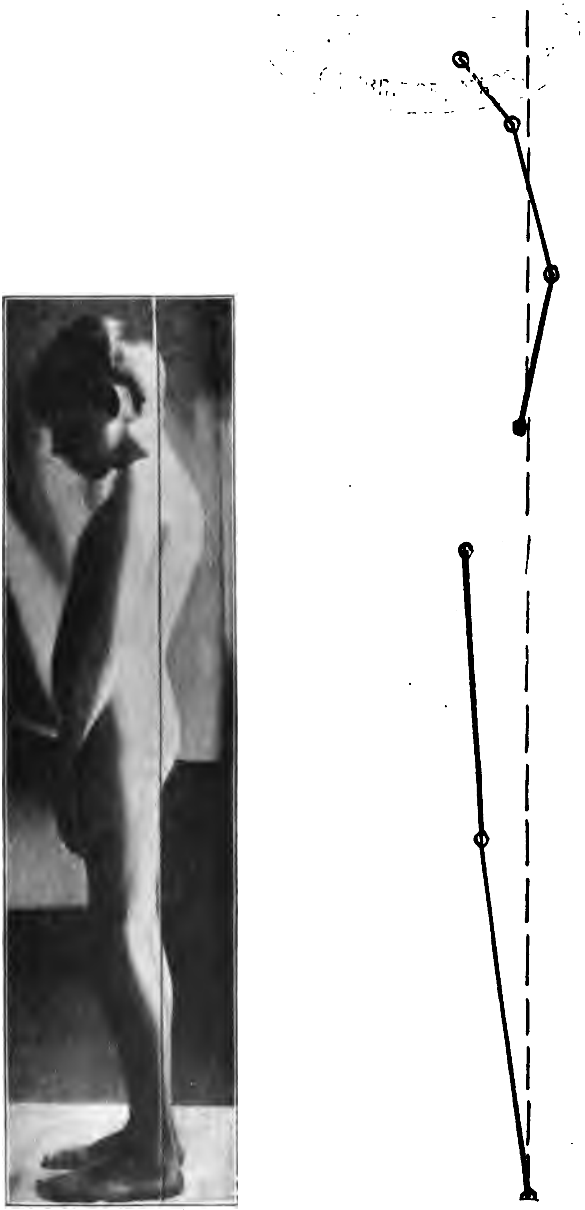


Fig. 8.—Attitude type *a*. **Photograph and tracing of same patient.**

TYPE B (Fig. 9). Backward projection greatest in the mid-dorsal region, the seventh cervical and mastoid points forming a straight line above it. There is generally lordosis, the pelvis is near the perpendicular, and the body axis lies, as a rule, behind the perpendicular. The legs are rather vertical, and if there is

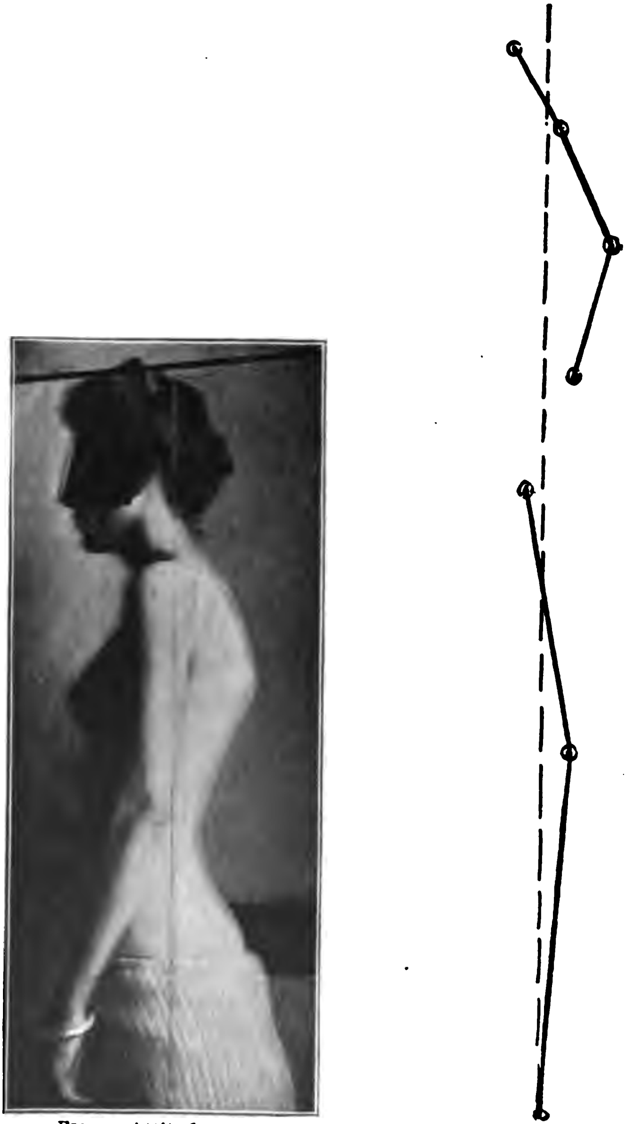


FIG. 9.—Attitude type *b*. Photograph and tracing of same patient.

not marked lordosis the knees are apt to be hyperextended. This type is second in frequency, and represents the seventh dorsal point as the most prominent point backward, with some lordosis in the lumbar region.

TYPE C (Fig. 10). The lower part of the back is straight, and the head runs forward from the seventh cervical. There is

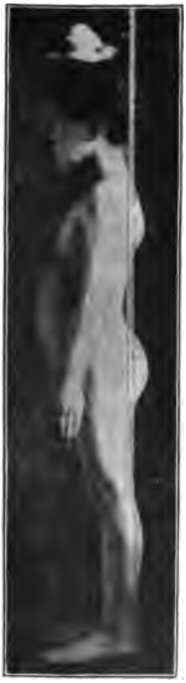
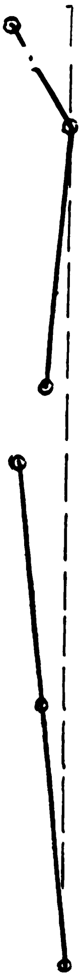


FIG. 10.—Attitude type *c*.



Photograph and tracing of same patient.

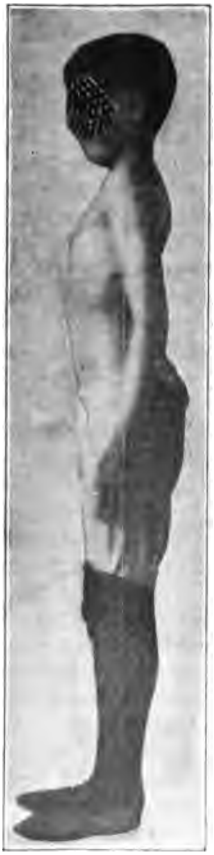
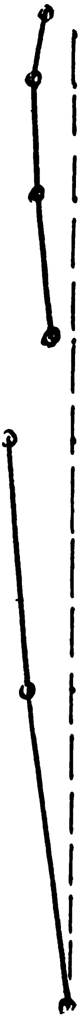


FIG. 11. Attitude type *d*.



Photograph and drawing of same patient.

generally not much lordosis, the pelvis is not pushed forward, but is near the perpendicular, and the body axis lies back as a rule. The knees may or may not be hyperextended. In this case the head is thrust forward from the upper part of the spine, and the body weight is thrown back.

TYPE D (Fig. 11). The spinal points form a nearly or quite straight line. The back is nearly flat, lordosis is marked, the pelvis is generally back, but it may be forward, and the knees generally somewhat flexed.

That these types are not quite constant, and therefore probably not very well separated, is shown by the fact that in tracings taken at considerable intervals occasionally the same case would appear in Type A, and then in Type B, or vice versa.

Having formulated independently this classification of types of variation in faulty attitude from my tracings alone, and having rejected the other methods that I had previously tried, which took into account the relation of the legs and pelvis to the perpendicular, the relation of the whole attitude to the perpendicular, etc., as introducing too many inconstant elements, I was interested to see what relation these bore to the types formulated by Staffel. Points were marked on his figures corresponding to the bony landmarks selected, lines drawn, and a perpendicular erected through the external malleolus. To my surprise I found that his classification and my own were practically identical, as may be seen by the tracings. Group A in my classification corresponds to his "round back" (Fig. 12); Group B is his "round hollow back" (Fig. 13); Group C is his "hollow back" (Fig. 14); and Group D is his "flat back" (Fig. 15). The difference between Groups C and D in his classification is not so distinct as I found it.

(3) The hyperextension of the legs and abnormal positions of the pelvis in many cases suggest that, possibly, some patients stand wrongly from some lack in the base of support. The frequent association of pronated foot with faulty attitude in growing children is of much significance.

The essential factor in producing faulty attitude cannot be formulated at this stage of the study. The primary cause is obviously muscular weakness; but whether it is general or confined chiefly to the spine or to the legs and pelvis cannot be definitely stated. As certain patients with round shoulders, for example (to be discussed in Section 5), acquire a much more correct attitude under treatment without obvious change in spinal outline, it cannot be assumed off-hand that the spine is in all cases the primary seat of the difficulty.

(4) As it has not been demonstrated that the origin of faulty attitude lies wholly in the spine, it cannot be assumed that the gymnastic treatment should be wholly directed to the spine. In general, the gymnastic treatment should resemble the "setting up

drill" of the military recruit, for exercises to straighten the spinal bowing and broaden the chest by themselves are only to be regarded as attacking part of the problem of treatment, for in many cases, at least, it is plainly evident that the vicious attitude is general as well as local. The treatment should therefore be general.

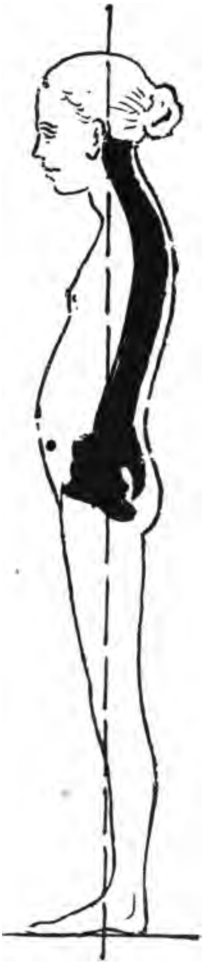


FIG. 12.—Staffel's round back.

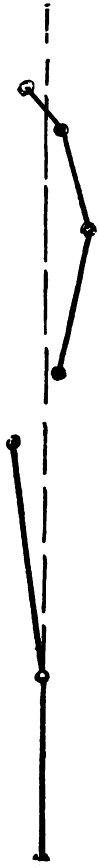


Diagram and tracing.

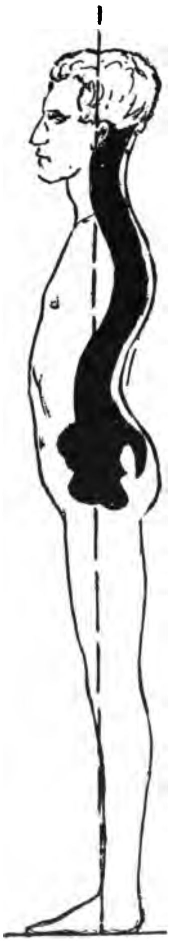


FIG. 13.—Staffel's round, hollow back.

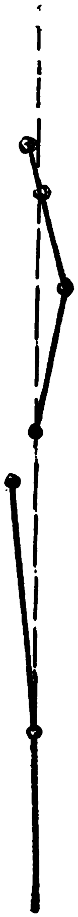


Diagram and tracing

It is obvious that when the pelvis is pushed forward and the hips hyperextended, ligamentous support is substituted for muscular and the whole attitude rendered vicious. Exercises for the abdominal muscles and the glutei and hamstrings must be an essential part of the treatment in such cases. The raising of heavy weights brings into exercise all of the muscles concerned in maintaining the erect position, and is in that sense a selective

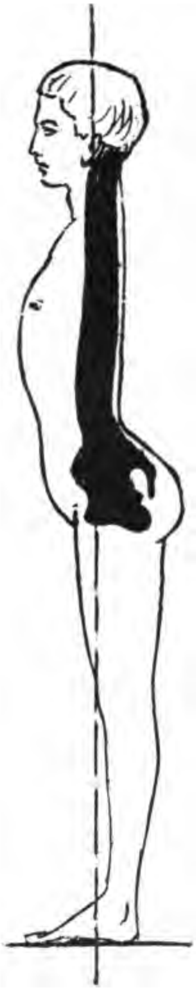


FIG. 14.—Staffel's hollow back.

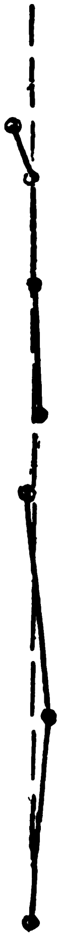


Diagram and tracing.

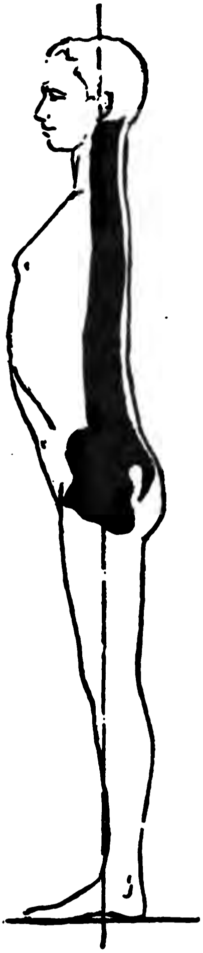


FIG. 15.—Staffel's flat back.

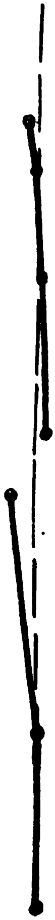


Diagram and tracing.

exercise. Backward flexion and stretching of the spine is, of course, useful, but a study of the essentials of the whole position will show that these special exercises are of less importance than is often supposed. The analysis of the results of treatment will

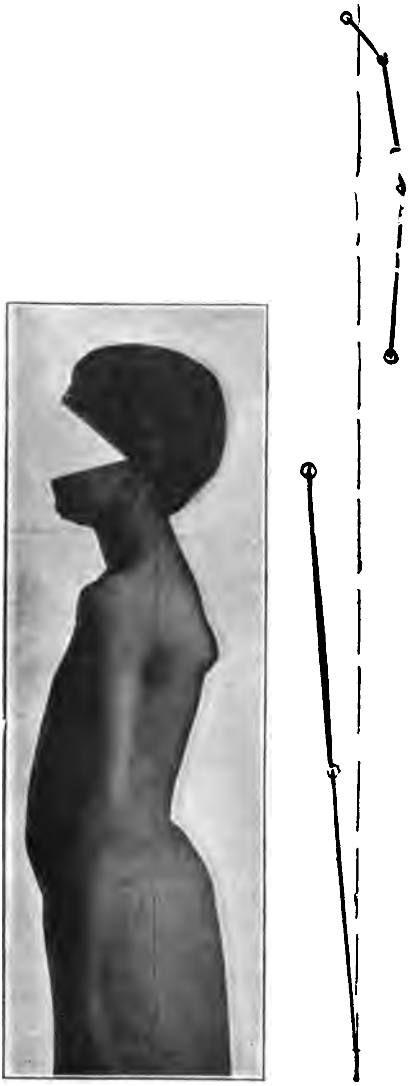


Fig. 16.—R. J.; tracing and photograph before treament.

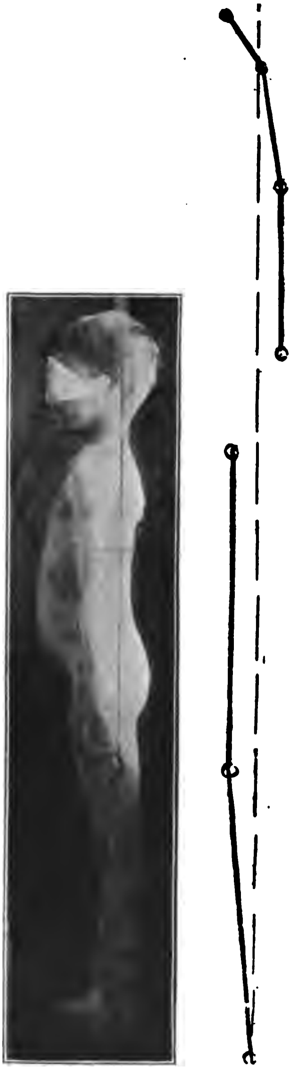


Fig. 16.—R. J.; tracing and photograph after treatment.

show that improved cases, as a rule, have been corrected more in their general balance than by any marked change in the spine. The importance of diminishing the muscular fatigue of these patients by daily enforced rest in addition to muscular exercise has been dwelt upon in another paper.* The same consideration applies to resting the muscles temporarily by light braces, applied to maintain a more correct position, in addition to gymnastic treatment.

(5) In analyzing by this method of measurement the changes in the attitude of patients brought about by gymnastics extending over a considerable period of time, certain interesting facts are to be found. There are six cases where back tracings and photographs before and after treatment are available. One showed no improvement after one year's treatment, four showed great improvement in their method of standing, but little or no change in the relation of the spinal points; one showed straightening of the spine.

The indication from the study of these cases and others which cannot be presented on account of the incompleteness of the records, is that the cure of the form of faulty attitude known as round shoulders is, in many cases, accomplished by a readjustment of the whole attitude, involving the relation of legs, pelvis and head, rather than by any marked straightening of the spine. The bearing of this upon treatment is obvious.

The cases are as follows:

CASE I. C., in October, 1901, stood with the head forward and the seventh dorsal well back. The lower back was flat, the pelvis slightly forward, and the knees hyperextended. In May, 1902, the spinal outline was the same, but the knees were straight; the lumbar region was further forward, and the improvement had evidently been brought about by a change in the axis of the pelvis and not by any alteration in spinal outline.

CASE II. R. J., in April, 1901, stood with a general curve to the back, lumbar spine flat, and pelvis forward, with the axis of the legs inclined sharply forward. November, 1901, the spinal outline was unchanged, but the pelvis has been carried back, and the spine was more over it. The legs, instead of slanting forward, were upright and under the pelvis (Fig. 16).

CASE III. G. F., February, 1901, general round of back, pelvis forward, lumbar spine flat, knees hyperextended. October, 1901, slight change in spinal outline, the mastoid having moved up and back in relation to the seventh cervical, but the chief change was in moving back of the pelvis, increase in lumbar curve and straightening of the legs (Fig. 17).

CASE IV. C. B., January, 1901, general round to back lumbar

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* R. W. Lovett: Transactions of the American Orthopedic Association, x, p.

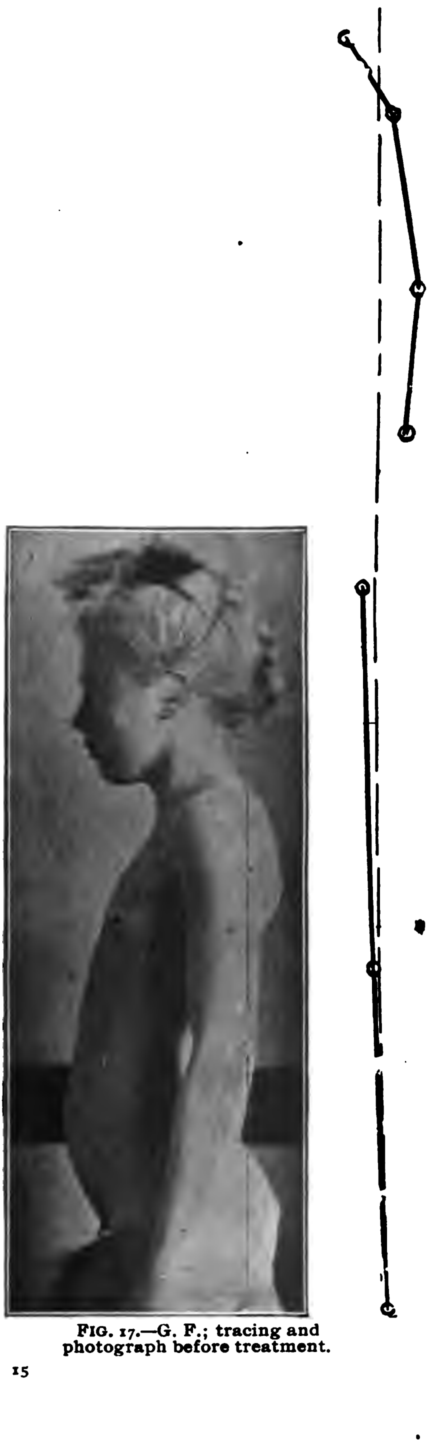

FIG. 17.—G. F.; tracing and photograph before treatment.

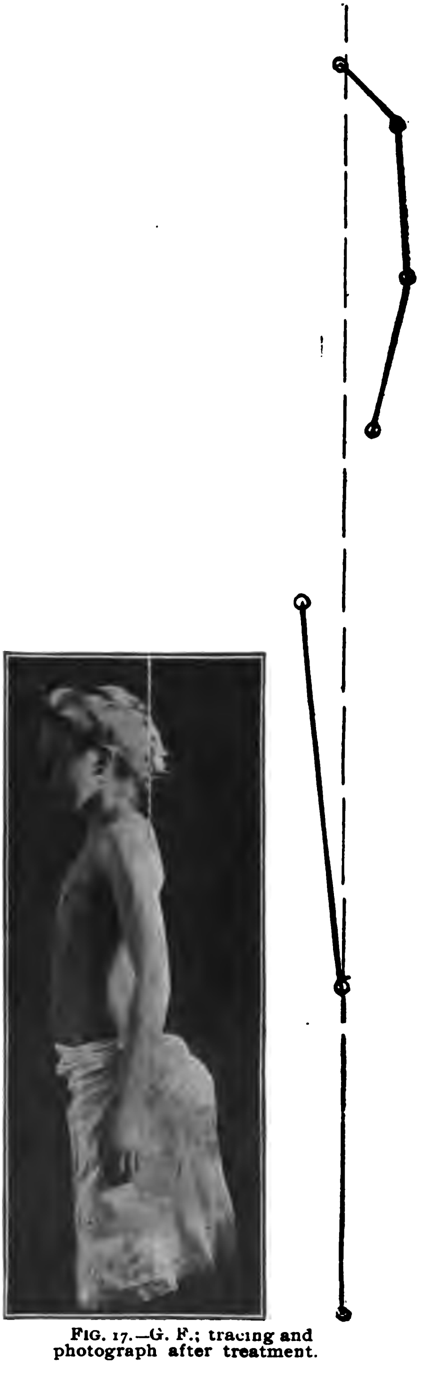

FIG. 17.—G. F.; tracing and photograph after treatment.

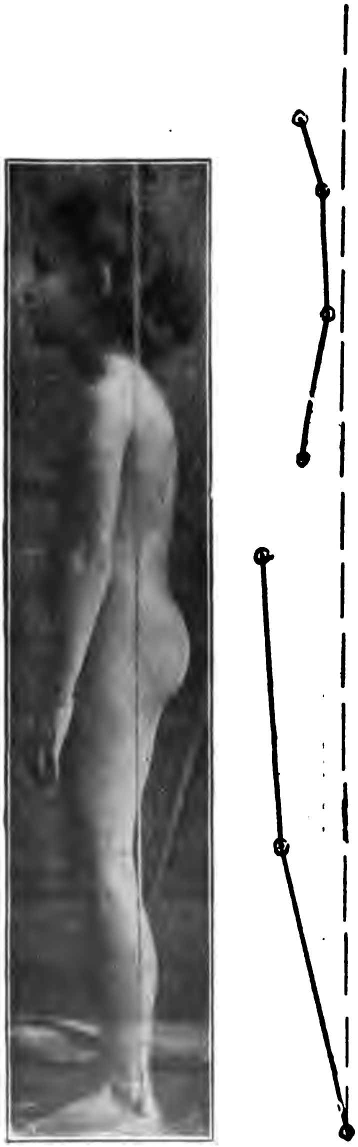

FIG. 18.—C. B.; tracing and photograph before treatment.

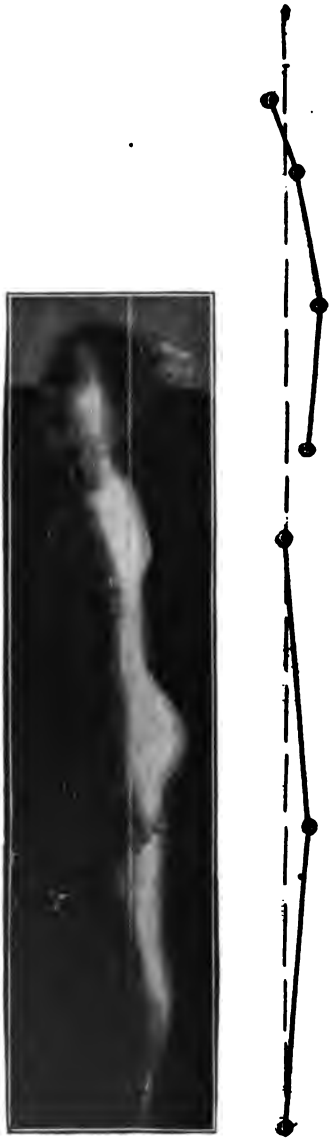

FIG. 18.—C. B.; tracing and photograph after treatment.

spine flat, pelvis very far forward, knees slightly bent, leg axis far forward, whole body weight forward. November, 1901, *no marked change in outline of spine;* slight straightening, possibly; pelvis back, increase of lumbar curve, straightening of legs, and hyperextension of knees (Fig. 18).

The conclusions from this paper would seem to be as follows: That the study of faulty attitude has been incomplete because the spine alone has been considered rather than the relation of the legs and pelvis to the spine and the relation of the whole body to the perpendicular; that a uniform method of measurement and record is desirable; that the method described gives a side elevation of the whole attitude and the relation of legs, thighs, pelvis, spine, and head to each other and to the perpendicular; that the seat of faulty attitude is not as yet formulated; that gymnastic treatment should be general and local.

THE DAILY VARIATION IN THE POWER OF VOLUNTARY MUSCULAR CONTRACTION.

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The investigation reported below was undertaken at the instigation of Dr. O. P. Jenkins, of Stanford University, to whom thanks are due for valuable criticism and aid. This work is concerned chiefly with the normal daily variation in the writer's ability to do voluntary muscular labor. It is plainly a study in individual physiology and must be considered as such.

Apparatus—The apparatus employed was very like Lombard's modification of Mosso's ergograph. (See drawing, Fig. 1.) A kymograph of the Ludwig type was used in making records of the contractions. The experiments were made upon the muscle that flexes the last phalanx of the second finger,—i. e., the flexor profundis digitorum. Ordinarily this muscle has been used in combination with the flexor sublimis digitorum in experiments of this kind. If a single muscle is tested, the results are probably less liable to variation. It cannot be doubted that the simplest results come with the least complicated movements, and it is certainly true that the muscular control of the last phalanx of the second finger is more simple than that of the whole finger. In Fig. 1 there is a representation of a contrivance by means of which the finger was held firmly in place and the proper joints immobilized. It consists of three uprights, two of which are stationary, and against these the palm of the hand rests in the course of the experiment. The third upright is adjustable and may be fitted in such a position as to prevent any movement of the first phalangeal joint,—i. e., the joint controlled by the flexor sublimis digitorum muscle and the lumbricales, whose influence it is intended to eliminate. A broad aluminum ring worn over the finger at the region of contact with the adjustable upright prevented the pain that would naturally come with the great pressure against the narrow surface of the upright. By this arrangement the only movement communicated to the weight and to the recording tape is that of the last phalanx. The work done was probably only that of the flexor profundis digitorum and particularly of those fibres that have a direct influence on the tendon that reaches the phalanx in use. A leather collar (C in Fig. 1) was fitted over the last phalanx, care being taken that it should occupy the same

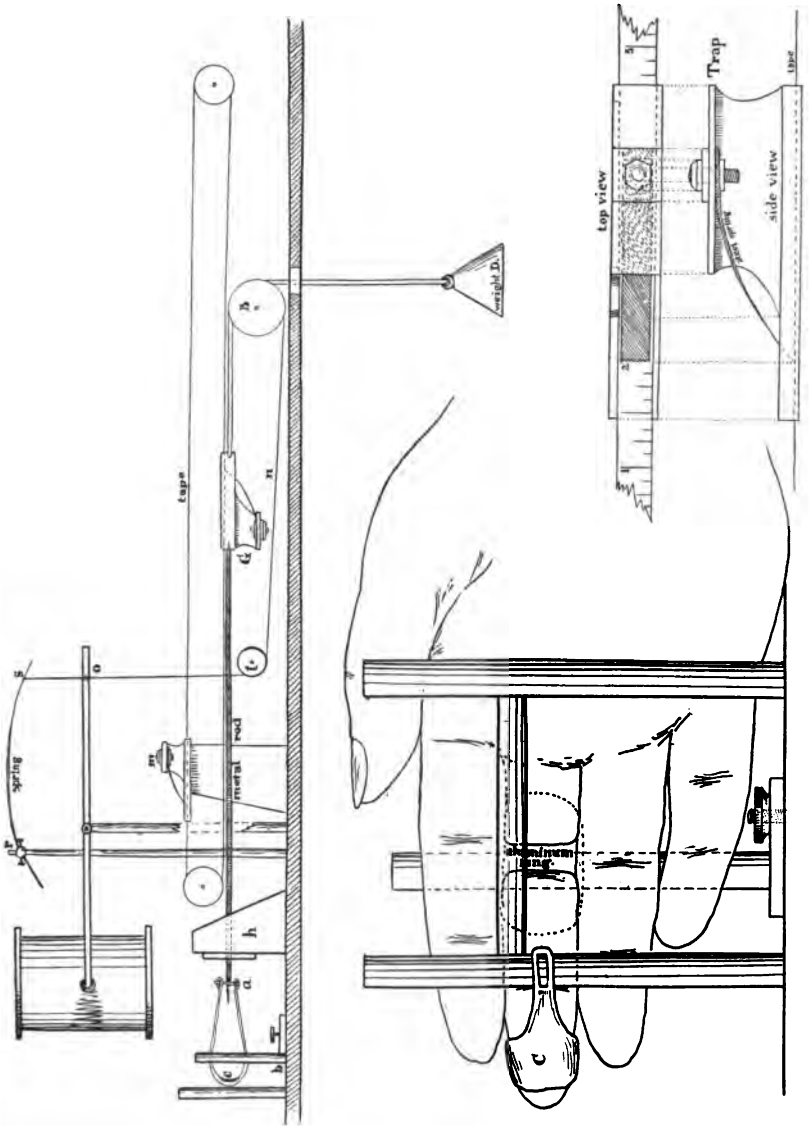

Fig. 1.

position on the finger at each experiment. In order to eliminate elasticity in the connections, a metal rod—a bicycle spoke—was placed between the collar and the movable trap G, the collar being attached in such a manner that the distance between the finger and the metal rod could be varied at will. On the rod at K was placed an aluminum disc which, coming in contact with the block H, through which the rod ran, checked the fall of the weight D. The weight was also supported in part by a block below it.

The movable trap G was made of aluminum and consequently was very light. When the weight was raised on contraction of the muscle, the trap passed over the tape which was held in place by the stationary trap M. On relaxation of the muscle and consequent fall of the weight, the trap G caught the tape and drew it along, thus recording the height to which the weight was lifted. By this arrangement of the traps the varying resistance of the tape and its pulleys was eliminated during contraction. The tape used was one hundred and fifty centimeters long.

The pulley B, over which the heavy catgut weight-cord ran, was constructed with ball bearings to lessen the possibility of varying friction. From the pulley a thread N ran to the lever O, passing over a pulley with pivot bearings. The lever, supported at its middle by a pivoted axle-fulcrum, registered at its point the exact amplitude of movement made at O, which was the same as that of the weight. This recording lever was held in position by a light spring R-S, which had a resistance of less than one ounce to each contraction.

The weight lifted at each contraction, then, was the sum of the resistance of the pulleys plus the tension of the spring R-S plus the load D. Careful observations were made at frequent intervals in order to ascertain that there was no variation in resistance while the weight D remained constant. Some little trouble was experienced in gaining this result and a number of plans were tried before this arrangement was finally adopted.

A pendulum vibrating once every second gave the signal for contracting the muscle. This was the rhythm used in all these experiments.

Time and Conditions of Experimentation.—This work was undertaken during the spring of 1898, but it was not until January, 1899, that the apparatus in present use was finally devised. The experiments herein reported were performed at intervals during the first eight months of 1899. The writer, on whom most of the experiments were performed, was twenty-four years of age and was in good bodily health during most of the time. There was one week of influenza in February, the influence of which was recorded. Until the middle of May, the results obtained were affected by the various activities that came with twenty hours a week of work in the gymnasium. This work consisted in leading drills and sections on various pieces of apparatus and in organizing and directing the various details of the gymnasium program. In April and May the depressing effects of other severe, confining work seemed apparent. The tracings made since the 18th of May are under normal and very regular conditions. It can easily be seen that these last records vary less from a regular order or rhythm and must be regarded as a better representation of the normal daily variation in the muscular power of the writer.

The second finger of the right hand was used in all experiments prior to the 26th of May; after that date both the right and left hands were used.

In each experiment the muscle in use was contracted once a second. About a quarter of a second was spent in contraction, one-quarter in relaxation, and half a second in rest. In each case the first failure to lift the weight was the signal for ending the experiment. The weight was increased several times during the period of experimentation as the muscles grew stronger.

The writer had no curve of daily variation in mind when he began this work. During the course of each experiment his attention was fixed on the pendulum which gave the signal for contraction, and every contraction was intended to be a maximal contraction. Every experiment was intended to show the greatest amount of work possible at that particular time with the weight and rate employed. In the great majority of the experiments, the tracings soon disappeared from view and the recording tape was hidden from sight, so that these "psychic" influences could not have been great even if the writer had been inclined to permit them to affect him.

Grouping of Results.—From what is stated above concerning the conditions under which this work was done, it can readily be seen that the results may be classed under two heads: First, those that came under the varied influences of the spring semester of college work, in which may be noted the influences of the fatigue of the day and rest of the night, of influenza, of overwork, of exercise, of pulse rate, and of respiratory rate; and second, those that came under the more constant influences of a designedly regular life during the latter part of the summer vacation. Here may be noted the diurnal variation in muscular power, the influence of meals, of temperature, and some of the factors noted in the earlier experiments. These results are taken up in order and detail in the remaining parts of this paper.

Influence of the Fatigue of the Day.—It can readily be seen that any diminution or increase in the power of the muscle experimented upon would produce a shorter or longer fatigue curve; the weight would be lifted to a greater height or to a lesser height, the muscle would do more or less work. If, now, tracings are made at different times of the day, or on different days, this power will be found to vary considerably in response to the various depressing and restoring influences that affect the supply of voluntary muscular strength. Mosso (12) and Maggiora (10) found that psychic as well as general muscular fatigue apparently reduces the power of voluntary muscular contraction. A long quiz or lecture as well as a prolonged march diminished muscular power. Any influence which affects the central nervous system or the peripheral muscular organization apparently influences the power of contraction.

It would be natural, then, to expect that the power of voluntary muscular contraction would be less at night than in the morning, for during the day the muscles and the central nervous system are under a continual and varying activity. Experiments have demonstrated that this continued stimulation may lead to fatigue. Lombard in his observations found that in a majority of cases his evening records represented a smaller amount of work than did the morning records. In the experiments made by the writer at different intervals between February and May, 1899, there were thirty comparisons made between morning power at 7 a. m. and evening power between 8 and 9 p. m. On twenty-four out of thirty days there was a smaller amount of work recorded at night than in the morning. (See Table I.)

This loss of ability to do work through the day may be due largely to the fatigue of the central nervous system. According to Mosso and Maggiora, the food taken into the body each day quickly restores a certain amount of power, presumably in the muscles themselves, and sleep is necessary for the restoration of power in the nervous system. Maggiora and Vaughan Harley (3) watched the influence of fasting upon their voluntary muscular power and found it greatly diminished after a day without food. Loss of sleep produced a like diminution. In the one case, food restored the power lost; in the other, rest and sleep were necessary for such restoration. Between February 6 and April 29, the writer made thirty-two comparisons of morning ability to do work with that of the evening before. Tracings were made at 7 a. m. and in the evening between 7 and 9. On twenty-four days there was a gain during the night; and on six days, a loss. On one day there was no change, and in the last tracings taken in May, where both hands were experimented upon, there was a gain with the right and a loss with the left hand. (See Table II.) These results verify those gained by Mosso, Maggiora, and Lombard (7).

A combination of mental and muscular fatigue has a very evident influence upon the tracings made with the ergograph. Between the 4th and the 9th of April, the writer was very busy with mental and physical work, the united influences of which were very exhausting. The morning and some of the evening exercises taken at that time, and for several days afterward, are given below. The weight lifted was 3 kilos.

	7 A. M.		6 P. M.	
April	Height	Work Done	Height	Work Done
3	106.3 cm.	3.189 kgm.	100.8 cm.	3.024 kgm.
4	104.61 "	3.138 "		
5	104. "	3.120 "	88.6 "	2.658 "
6	82. "	2.460 "		
7	83.4 "	2.002 "	86.3 "	2.58 "
8	86.1 "	2.583 "		
9	87.4 "	2.612 "		
10	86.5 "	2.595 "	102.1 "	3.063 "
11	90 4 "	2.712 "		
12	125. "	3.750 "		

It can easily be seen from the table above that the measurements of muscular power became considerably smaller during the period of greatest mental and physical activity, and then regained what was lost after the strain was over. Some like influences were encountered during the first week in September when the writer was busy with anthropometric work. During the four or five days' work of that week forty men were measured, each measurement requiring about half an hour of time. Records were made only on the 5th and 6th, in the afternoons of which days five and four men were measured respectively; that is, five on the 5th and four on the 6th. The records are given below:

	2 P. M.		5 P. M.		
Sept.	Height	Work Done.	Height	Work Done	
5...	41.3 cm.	1.4455 kgm.	25.3 cm.	.8855 kgm.	L. hand wt. 3½ kgm.
6...	49.5 "	1.7325 "	25.6 "	.8960 "	" " " " "
6...	75. "	3 1550 "	52.6 "	1.8410 "	R. " " " "

There is a normal decrease in ability to do work between 2 and 5 p. m. in the case of the writer, but the losses noted above are much in excess and must have been due to some influence that comes with the measuring season.* The writer usually experiences a great deal of weariness at this time and was not greatly surprised to find such a difference in the records taken before and after an afternoon's work. As usual, each contraction was intended to be a maximal contraction and the efforts were continued until the first failure to raise the weight.

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* For normal variations between 2 and 5 p. m., see Table IV, or Summary of Conclusions.

TABLE I.

Date.	Weight, 2½ kilos	
	7 A. M.	8–9 P. M.
February.		
6	2.9400 kgm.	2.3375 kgm.
7	2.9425 “	2.5925 “
8	2.9600 “	2.7325 “
9	2.8275 “	2.6900 “
10	2.4425 “	2.3209 “
(Influenza from Feb. 10 to Feb. 17.)		
March.	Weight, 2.95 kilos.	
12	1.53095 kgm.	1.95440 kgm.
20	1.63735 “	1.34526 “
21	1.66380 “	1.99330 “
22	1.73660 “	1.76130 “
23	1.57530 “	2.04435 “
26	2.37184 “	2.34230 “
27	2.34230 “	2.10925 “
29	2.93525 “	2.59305 “
30	2.65205 “	2.40130 “
April.		
1	2.82020 kgm.	2.83179 kgm.
4	2.08570 “	2.69040 “
6	2.44260 “	1.69625 “
11	2.66680 “	3.40725 “
12	3.68930 “	3.38955 “
13	2.87035 “	2.34230 “
14	3.18010 “	2 46620 “
15	2.71105 “	2.60485 “
16	2.84675 “	2.38655 “
18	2.62845 “	2.40130 “
25	2.46425 “	2.32755 “
	Weight, L. Hand, 2.73 kilos.	
May.	“ R. “ 3.86 “	
26 L.	1.59432 kgm.	1.34043 kgm.
R.	2.20406 “	1.94158 “
27 L.	2.16964 “	2.02839 “
R.	2.42794 “	2.51600 “
28 L.	2.21130 “	2.19765 “
R.	3.00010 “	2.94132 “
29 L.	2.39967 “	2.37783 “
R.	2.95290 “	2.86798 “
30 L.	2.38329 “	2.09391 “
R.	2.82552 “	2.63639 “

The right hand was used in all experiments up to May 26; after that date both hands were experimented upon.

TABLE II.

Date.	Weight, 2½ kilos	
	7 A. M.	8–9 P. M.
February.		
6		2.3675 kgm.
7	2.9425 kgm.	2.5925 “
8	2.9600 “	2.7325 “
9	2.8275 “	2.6900 “
11		1.9725 “
March.	Weight, 2.95 kilos.	
19		1.4661 kgm.
20	1.6372 kgm.	1.3452 “
21	1.6638 “	1.9933 “
22	1.7366 “	1.7613 “
23	1.5753 “	2.0443 “
24	1.7641 “	1.8644 “
25		2.0650 “
26	2.3718 “	2.3423 “
27	2.3423 “	2.1092 “
28	2.7464 “	2.6384 “
29	2.9352 “	2.5930 “
30	2.6520 “	2.4014 “
31	2.8969 “	3.0827 “
April.		
1	2.8202 kgm.	2.8317 kgm.
2	2.8615 “	2.7523 “
3	3.13585 “	
4	2.0857 “	2.69040 “
5		3.0680 “
11		3.4072 “
12	3.6893 “	3.3895 “
13	2.8703 “	2.3423 “
14	8.1801 “	2.4662 “
15	2.7110 “	2.6048 “
16	2.8467 “	2.3865 “
17	2.4780 “	
25		2.3275 “
26	4.8409 “	
27		3.3541 “

TABLE II.—*Continued.*

Date.	Weight, L. hand, 2.73 kilos. " R. " 3.86 "		
		7 A. M.	8–9 P. M.
May 26....	R.	1.5943 kgm.	1.3404 kgm.
27....	L.	2.1696 "	2.0283 "
	R.	2.4279 "	2.5160 "
28....	L.	2.2113 "	2.1976 "
	R.	3.0001 "	2.9413 "
29 ..	L.	2.3996 "	2.3778 "
	R.	2.9529 "	2.8679 "
30....	L.	2.3872 "	2.0939 "
	R.	2.8255 "	2.6363 "

Until the 26th of May the right hand was used in all the experiments made; after that date both hands were worked each time.

Influence of General Health.—During the month of February, the writer was confined to his room for a week by an attack of grip. The morning tracings for the four days preceding show a definite fall in muscular power. The records are entered below:

Feb.	Height.	Work.
8	118.4 cm.	2.960 kgm.
9	113.1 "	2.8275 "
10	87.7 "	2.4425 "
11	81.3 "	2.0325 "

Hour, 8 A.M. Weight, 2½ kgm.

There was a decrease in the height to which the weight was lifted from 118.4 cm. to 81.5 cm., and a decrease in work done from 2.960 kgm. to 2.0325 kgm. On the 11th, the last day recorded above, the writer had a fever of 103 degrees and was confined to the house for the following week. Tracings were made again on the 21st. The most noticeable gain came on the first four days after resuming work. The records are given below.

Feb.	Height.	Work.
21	72 cm.	1.8 kgm.
22	94.7 "	2.3675 "
23	100.9 "	2.5225 "
24	104.2 "	2.605 "

Hour, 8 A.M.

The weight was lifted to a height of 72 cm. on the 21st. On the 24th, there had been a gain of 32.2 cm. A rest of ten days under normal circumstances might have taken the muscles somewhat out of training and decreased their ability to do work. Unfortunately the writer has no record of such a rest influence which can be compared with the influence of these ten days of sickness.

Influence of Overwork.—If tracings are made with but a short interval of rest between them, the fatigue of one experiment will influence the amount of work recorded in the next. Mosso and Maggiora found that the amount of rest necessary to restore power after the fatigue of one of their experiments varied with different individuals, but was ordinarily between an hour and a half and two hours. Lombard found, near the end of a long season of experimental work of this kind, that fifteen minutes was sufficient for the restoration of normal power in his case. This was after a great deal of experimental work which trained the muscles in use and so rendered them able to recuperate more rapidly than they could have done early in the season. The writer found, in his case, that the first two or three tracings may be but a short time apart and not show any decrease in the amount of work done. The following table records a number of experiments made with but short intervals of rest between. The weight used was 2.95 kilos.

April.	Hour.	Height.	April.	Hour.	Height.
3	7.00 A. M.	106.1 cm.	12	7.00 A. M.	125. cm.
	7.20 "	108.1 "		7.30 "	119. "
	7.40 "	92. "	14	7.00 "	107.8 "
5	7.00 "	104. "		7.30 "	99.5 "
	7.30 "	95. "	17	7.00 "	84. "
10	7.00 "	86.5 "		7.30 "	82. "
	7.30 "	95.8 "		6.28 P. M.	100.8 "
				6.48 "	102. "
				7.05 "	76. "

These tracings were taken at times as far removed as possible from the influence of meals. It will be seen on referring to the table above that out of the six groups there recorded, three show a gain between the first and second tracings, and that two of those three are groups in which the experiments were made only twenty minutes apart. But the fact that there is sometimes a falling off between the first and second tracings would render tracings taken under such circumstances unreliable for comparative purposes, and would make it pretty definitely true that, in the writer's case at that time, half an hour was not sufficient time for recuperation.

In a series of tracings an hour is probably enough time for rest in his case, provided other conditions are normal and not too many tracings are made. The influence of training seems to be a powerful factor in one's ability to recuperate rapidly. Less time was needed after some weeks of experimental work than was necessary in the beginning. This seems to have been the experience of Lombard.

Influence of Exercise.—It was noticed early in this work that sometimes on reaching the laboratory after a brisk ride on a bicycle, there would be a surprising increase in the amount of work recorded. It was surmised that perhaps the exercise of the ride might have been the cause, and the following tests were made. Tracings were made at short intervals until fatigue was unmistakably present and then a rapid run of about three hundred yards was made. Immediately afterward additional tracings were made recording the amount of work then possible. The weight used was 2.95 kilos.

April.	Hour.	Pulse.	Height.
2	8.00 P. M.	87 per min.	93.3 cm.
	8.05 "	84 "	78. "
	8.10 "	88 "	68. "
		A short run taken	
	8.15 "	120 per min.	80.8 "
3	8.14 "	Not observed	59. "
		Short run	
	8.25 "	Not observed	68 5 "
4	9.00 "	79 per min.	68.5 "
		A rapid walk of 100 yards	
	9.05 "	114 per min.	77.5 "
		Short run	
	9.10 "	114 per min.	71.2 "
13	9.00 "	77 per min.	79. "
		A rapid walk of 100 yards	
	9.15 "	100 per min.	96. "
		A run of 100 yards	
	9.30 "	138 per min.	107.5 "

The results on April 4th do not show the influence of exercise as decidedly as do those of the 2d, 3d and 13th. At the same time, the short run may have saved the record a greater fall than that of 6.3 cm. The experiments made on the 2d, 3d and 13th show an unmistakable gain in power after exercise.

A rise in pulse rate and a rise in the rhythm of respiration always accompanies general muscular movement. The question then arises: Is the influence of exercise upon the power of contraction an influence brought about by the increase in the pulse rate, or by the increased respiratory rhythm? The change in pulse rate can scarcely be directly responsible for such an increase in muscular power, because the amount of blood supplied an organ is largely independent of the pulse rate. The muscles of the arm probably receive less blood when the muscle groups of the legs are active and calling for a large amount of blood.

Influence of Pulse-Rate.—A careful record was kept of the pulse before every experiment. The table below is taken from the records made in August. These records were made in every case after sitting quiet for a few minutes.

RATE OF PULSE.

August	8 A.M.	10 A.M.	12 M.	2 P.M.	4 P.M.	6 P.M.
2	94	77	66	87	79	80
3	..	73	65	79	77	81
4	79	76	70	..	..	84
5	73	70	61	81	73	87
7	79	72	68	86	63	84
8	88	80	73	81	74	86
9	80	69	67	80	77	88
10	82	74	65	84	69	84
11	73	70	66	84	78	82
12	79	68	63	84	77	84

August	7 A.M.	9 A.M.	11 A.M.	1 P.M.	3 P.M.	5 P.M.
14	71	93	80	88	80	71
15	70	85	84	88	78	64
16	69	86	82	78	70	82
17	66	90	71	80	64	64
18	67	86	78	78	71	71
19	66	86	79	82	73	

On the days recorded above, breakfast was taken at 7.15 a. m. and dinner between 12 and 1 p. m. Between 4 and 6 every afternoon a game of hand ball was played, which exercise was followed by a cold bath. These things naturally produced a high pulse. The tendency of the pulse is to go down between meals, as can easily be seen from the table. A record of the variation in power for the same time is shown below (see Table IV. and Summary). It can be seen at a glance that there is no relation between the ordinary daily variation in pulse rate and the ordinary daily variation in muscular power. For instance, the pulse rate falls until noon; the work done by the muscle increases in quantity until 10 or 11 o'clock in the morning.

Influence of Respiration.—In order to determine the influence of the rate of respiration the following experiments were performed. Under ordinary circumstances the writer has a respiratory rhythm of about twelve to the minute.* Ergographic records were made during normal respiration, followed immediately with records of a series of contractions during which the rate of respiration was voluntarily increased. The weight used was 3.4 kilos.

Aug.	Hour.	Pulse.	Respiration.	Height.
26	4.00 P.M.	68	Normal......	R. hand 117.8 cm.
	4.05 "		"	L. " 91.3 "
	4.15 "		60 per minute.	R. " 121.6 "
		(Felt dizzy and "things looked dark.")		
28	11.00 A.M.	74	Normal......	R. hand 126.6 cm.
	11.03 "		"	L. " 100.4 "
	11.06 "	76	60 per minute.	R. " 136.3 "
	11.20 "	76	Normal.......	L. " 104.2 "
	5.00 P.M.	72	Normal.......	R. hand 101.1 "
	5.03 "		"	L. " 59.1 "
	5.08 "	76	60 per minute.	R. " 124.4 "
	5.11 "		Normal......	L. " 93.8 "
29	11.00 A.M.	80	Normal.....	R. hand 128.6 "
	11.03 "		"	L. " 107.6 "
	11.07 "	84	"	R. " 53.9 "
	11.10 "		"	L. " 30.6 "
	11.13 "		60 per minute.	R. " 131.6 "
30	6.30 P.M.	60	Normal.......	R. hand 104.8 "
	6.33 "		"	L. " 95.2 "
	6.36 "		"	R. " 55.6 "
	6.39 "		"	L. " 48.4 "
	6.41 "		60 per minute.	R. " 118. "
	6.43 "		Normal.......	L. " 96. "

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*A result of gymnasium training. The normal rate is seventeen to the minute, or thereabout.

In each case above an increase in the rapidity of breathing produced an immediate feeling of strength as well as an actual increase in the ability to do work. After the muscles had been tired so much that they could do less than their normal amount of work and gave unmistakable evidence of fatigue, the increase in the rate of breathing not only restored the lost power but also relieved the muscles of all feeling of discomfort. An increase in the rate to thirty a minute produced a like result.

Aug.	Hour.	Pulse.	Respiration.	R. Hand.	L. Hand.
31.....	6.00 p m.	66	Normal......	50 cm.	31 cm.
	6.05 "		30 per minute .	62 "	43.4 "

The weight was 3.86 kilos.

It is evident, then, that the increased rate of breathing, for some reason or other, restored more than all the power lost in preceding fatigue. A slight increase in pulse rate accompanying the greater respiratory activity was recorded in some of the experiments, but this was due also to the exercise performed during the experiment, and, as proven a few pages back, could not have produced the results obtained.

The writer is unable to say how this increase is brought about. It may be an influence of the products of muscular contraction reaching the cells of the central nervous system, or the fibres of other muscles, and making them more irritable, or it may be an influence of an overflow of motor impulses from the nerve cells controlling the activity of the respiratory muscles. That there is an intimate relation between respiration and muscular effort is apparent in any athletic contest or gymnastic feat.

Influence of Meals.—All investigators of this particular phase of our subject have observed a rise of power after a meal. Especially is this to be noticed if there has been an excess of general muscular fatigue or if the individual has gone without food for a longer time than usual. In the experiments tabulated in Table III, nine record a gain in power immediately after a meal and six show a loss that is usually insignificant when the influence of the fatigue of the preceding experiments is considered. In three of those six cases there was a gain found after a lapse of from fifteen to thirty minutes. During the month of August, 1899, there were made thirty-three observations of changes in power occurring after the noonday meal. Two individuals were experimented upon, the writer and a friend.* Twenty-eight of the thirty-three records indicated a gain after the meal. These observations were made an hour or an hour and a half after the beginning of the meal. At the same time twelve experiments were made upon the writer's testing the influence of the morning meal. A tracing at seven and one at nine o'clock was the rule. Breakfast came at a quarter after seven. There was no variation at all in this series of observations; the nine o'clock record was always larger than that taken at seven. There was no test made of the evening meal. (See Table IV.)

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*I have to thank Mr. W. H. Beach of Stanford University, for his generous gift of time and service during a part of this period of experimentation.

TABLE III.

April	Hour	Height	April	Hour	Height
3.....	6.28 P. M.	100.8 cm.	10.....	7.00 A. M.	86.5 cm.
	6.48	102 "		7.30	95.8 "
	7.08	76 "		Breakfast	
	Dinner			8.00	92.7 "
	7.45	77.5 "		12.35 P. M.	83.7 "
				Lunch	
				1.10	85 "
				6.50	102 "
				Dinner	
5.....	7 00 A M.	104 "		7.10	103.2 "
	7.30	95.8 "	12.....	7.00 A.M.	125.4 "
	Breakfast			7.30	119.5 "
	8.00	109 "		Breakfast	
	12.30 P. M.	95.3 "		8.00	114.4 "
	Lunch			12.40 P. M.	98 6 "
	1.00	81.9 "		Lunch	
	6.30	88.5 "		1.15	101.1 "
	Dinner			6.40	114.9 "
	7.05	83 "		Dinner	
	7.20	90.2 "		7.25	101.6 "
				7.55	114.2 "
			14.....	7.00 A.M.	107.8 "
				7.30	99.5 "
				Breakfast	
7.....	7.30 A.M.	77.9 "		8.00	100.3 "
	Breakfast			8.30	121.4 "
	8.00	78.5 "		1.00 P. M.	83.8 "
	12.40 P. M.	77.9 "		Lunch	
	Lunch			1.30	83.6 "
	1.10	81.7 "		2.00	99 "

Influence of Temperature.—No doubt extraordinary changes in temperature have an influence that affects the power of voluntary muscular contraction, but the daily changes under which these experiments were carried out had no pronounced influence. It was found that the daily temperature increased until about four or five o'clock in the afternoon. There was no interruption to this steady rise. That there is no controlling influence exercised from this source is evident from the fact that the variations in muscular power occur at intervals during the steady rise in temperature. The eleven o'clock fall in power came at a time when there was normally a rising temperature, and the fall after four o'clock came at the time of the daily maximum in temperature. It is perhaps true that very unusual changes in thermal condition have an influence upon muscular activity, and had any such changes occurred during this period of experimentation, they would have been noticed. The month of August in this region is particularly even and has no climatic irregularities.

Diurnal Variation.—These various influences that came with each day unite to bring about a general condition or measure of neuro-muscular power. When the factors in this composite of influences remain more or less constant, the measure of power is constant; when these factors vary in their strength, then the measure of power varies in its amount. During the early period of this investigation, these influences varied a great deal both as to their strength and their occurrences. The subject was carrying on a continuous program of muscular work which varied no little from day to day in intensity. The same variation was true of the mental activity of that period. Further than this, meals were necessarily irregular and the fare was unavoidably not the best. As a result the records for the months of February, March, April, and May, 1899, do not show any rhythmic uniformity and are valuable as evidence of the influence of food, rest, work, overwork, influenza, etc. A different set of influences dominated during August and September and the influences were reasonably constant. Meals were regular, sleep was regular, physical exercise was light and regular and taken at periods as far removed as possible from the hour at which the experiments were made, thus avoiding any considerable variation in pulse rate or respiratory rhythm. As usual, care was taken that the mental attitude should have as little influence as possible. The movement of the revolving drum carried the records quickly out of view.

The recording tape was hidden from sight, and every contraction was willed to be a maximal contraction. The first failure to raise the weight ended the experiment. With such conditions there appeared a fairly constant daily rhythm. For three or four hours after each meal there was a steady rise in the amount of work recorded. Thirty records were made of the morning variaation. In every case there was an after-breakfast rise in power. In twenty-two cases this rise continued until after ten o'clock.

Three records show a loss in one hand before ten o'clock, and in five instances the morning gain lasted until the noon hour.

The afternoon tracings, in twenty-two observations available for such comparisons, show first a gain and then, after three or four hours, a loss on sixteen days, and a continued gain on one day. On five days one hand recorded a gain and the other a loss of power after four p. m.

The daily variation in the writer's case, then, was composed of a rise in power until about ten or eleven o'clock a.m.; then a fall until about one p.m.; then a rise until four o'clock; and after that a fall until six. The morning maximum came at or near ten o'clock; the afternoon maximum, at or near four o'clock. (See Table IV and plotted curves appended.)

TABLE IV.

Breakfast at 7 A. M. Weight, 3.4 kilos. Dinner at 12.30 P. M.

	8 A. M.	10 A. M.	12 M.	2 P. M.	4 P. M .	6 P. M.
Aug. 2.						
L. Hand	.8160 kgm.	.9758kgm.	.7480kgm.	1.0200kgm.	1.1200kgm.	1.0506kgm.
R	1.5300 "	1.7476 "	1.9496 "	1.6966 "	2.2610 "	1.8122 "
Aug. 3.						
L	1.3906 "	1.7102 "	1.1730 "	1.3260 "	1.4524 "	1.5096 "
R	2.8492 "	2.8016 "	1.8360 "	2.7020 "	3.0566 "	3.0090 "
Aug. 4.						
L	1.7000 "	2.0026 "	1.5470 "	1.8088 "	1.9108 "	1.9380 "
R	3.2708 "	3.3048 "	2.5432 "	3.0172 "	3.3762 "	3.3286 "
Aug. 5.						
L	1.8360 "	2.0536 "	1.7544 "	1.7954 "	1.9244 "	2.0570 "
R	2.7574 "	2.9784 "	2.4073 "	2.5962 "	3.0974 "	3.1654 "
Aug. 7.						
L	2.0400 "	2.2474 "	1,7578 "	1.3154 "	2.1692 "	2.2678 "
R	2.7608 "	2.8425 "	2.4310 "	3.1586 "	3.1488 "	3.1518 "
Aug. 8.						
L	2.1046 "	2.3100 "	1.9584 "	2.1148 "	2.1182 "	2.1114 "
R	3.0974 "	3.1178 "	3.1210 "	3.1688 "	3.3964 "	3.2566 "
Aug. 9.						
L	2.1012 "	2.2238 "	1.8530 "	2.1012 "	2.2678 "	2.3068 "
R	3.1856 "	3.4354 "	2.8730 "	3.1628 "	3.4638 "	3.4136 "
Aug. 10.						
L	2.3188 "	2.6758 "	1.9210 "	2.2338 "	2.4208 "	2.3358 "
R	3.2776 "	3.5360 "	2.9512 "	3,3082 "	3.7156 "	3.4782 "
Aug. 11.						
L	2.0196 "	2.3120 "	1.9244 "	2.1590 "	2.3664 "	1.8462 "
R	3.2504 "	3.1858 "	2.1182 "	3.2810 "	3.4510 "	3.2030 "
Aug. 12.						
L	2.4902 "	2.6690 "	2.3460 "	2.6248 "	2.6384 "	2.5738 "
R	3.3966 "	3.4680 "	2.9580 "	3.4374 "	3.5020 "	3.4442 "

TABLE IV—*Continued.*

	Breakfast at 7.30 A.M.			Dinner at 12 M.		
	7 A.M.	9 A.M.	11 A.M.	1 P.M.	3 P.M.	5 P.M.
Aug. 14.						
L......	1.7850kgm.	2.6126kgm.	2.4928kgm.	2.9002kgm.	2.8720kgm.	2.1488kgm.
R......	2.8628 "	3.5156 "	3.4454 "	3.8974 "	3.6190 "	3.0854 "

	Breakfast at 7 A.M.			Dinner at 12 M.		
	7 A.M.	9 A.M.	11 A.M.	1 P.M.	3 P.M.	5 P.M.
Aug. 15						
L.	2.1896kgm.	2.5194kgm.	2.1046kgm.	2.5738kgm.	2.5942kgm.	2.1796kgm.
R.	3.0600 "	3.8284 "	3.3830 "	3.9406 "	3.7842 "	3.0770 "
Aug. 16						
L.	2.0536 "	2.4922 "	1.9890 "	2.5704 "	2.3800 "	2.5330 "
R.	3.1654 "	4.0528 "	3.1960 "	3.4148 "	3.1790 "	2.8900 "
Aug. 17						
L.	2.7420 "	3.1230 "	2.1930 "	2.5772 "	2.7336 "	2.3382 "
R.	3.1620 "	3.7020 "	2.9954 "	3.3762 "	4.0732 "	3.1790 "
Aug. 18						
L.	2.3222 "	2.8152 "	2.1080 "	2.7427 "	2.3902 "	2.0570 "
R.	3.2062 "	3.6176 "	3.0600 "	3.6182 "	3.3762 "	3.2402 "
Aug. 19						
L.	2.3188 "	2.7846 "	2.7286 "	3.0736 "	2.5806 "	2.0604 "
R.	3.1960 "	3.7774 "	3.3388 "	3.4204 "	3.0498 "	2.9274 "

	Breakfast at 7 A.M.				Dinner at 12.30 P.M.			
	8 A.M.	9 A.M.	10 A.M.	11 A.M.	12 M.	1 P.M.	2 P.M.	3 P.M.	4 P.M.
Aug. 21.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.
L.....	2.6282	2.8900	....	2.3494	2.0740	....	2.7948	....	3.0906
R.....	....	3.5360	4.2024	3.6040	....	....	3.5122	3.7842	4.0494
Aug. 22.									
L.....	2.5500	2.7744	....	2.4412	2.2814	....	2.4888	....	2.7370
R.....	....	3.4680	4.1888	3.7400	....	....	2.9650	3.2912	3.6080
Aug. 23.									
L.....	2.4310	2.9138	2.9138	2.7164	....	....	3.1552	3.2266	3.5020
R.....	....	3.4884	3.6448	3.1688	....	......	4.0528	3.7944	3.9780
Aug. 24.									
L.....	....	2.8628	3.1348	2.7846	....	....	2.9886	3.3388	3.4884
R.....	....	....	3.8862	2.7468	....	3.5734	3.6788	4.4064	4.3183
Aug. 25.									
L....	....	2.4684	3.2708	2.4650	....	....	3.0906	3.6176	3.6210
R.....	....	3.5428	2.6486	....	....	3.7502	3.6482	3.9134	4.1480
Aug. 26.									
L.....	....	2.9818	3.4204	2.6180	....	....	2.8798	2.8832	3.1042
R.....	....	....	3.6890	3.0124	....	3.3320	3.4760	3.7978	4.0052

TABLE IV—*Continued.*

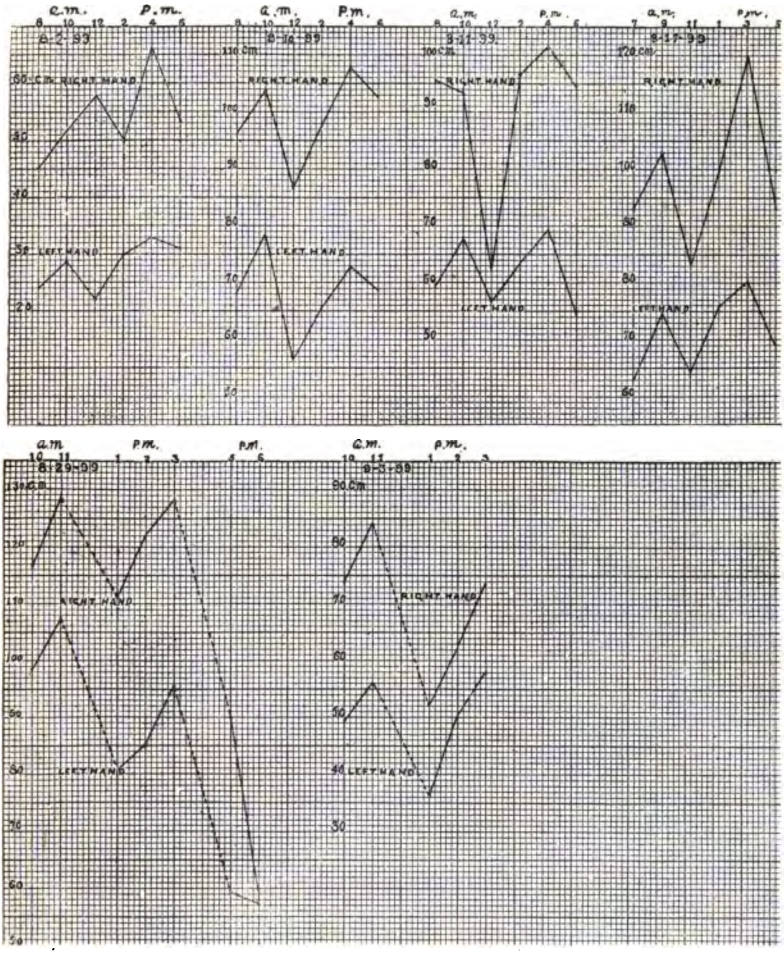
	Breakfast at 8 A.M.				Dinner at 12 M.				
	10 A.M.	11 A.M.	12 M.	1 P.M.	2 P.M.	3 P.M.	4 P.M.	5 P.M.	6 P.M.
Aug. 28.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.	Kgm.
L.....	2.9546	3.4034	2.9546	3.6210	2.2270	2.8764	2.8764	3.3014	....
R.....	3.8284	4.3044	....	3.6380	3.9780	....	4.3792	3.4374	....
An .									
R.....	3.9576	4.3724	....	3.7774	4 1480	4.3724	....	3.0600	2.0230
L.....	3.3520	3.6584	....	2.7506	2.8900	3.2776	....	2.006c	1.9550
Aug. 30.									
R.....	3.9168	4.3112	....	3.6142	3.9134	4.4098	....	3.0396	3.5632
L.....	3.4136	4.0528	....	2.4718	3.4816	3.7774	....	2.2134	3.2368
Weight of 3.8 kilos.									
Aug. 31.									
R.....	2.0844	2.8757	....	....	2.1230	2.4704	....	2.2388	1.9300
L.....	1.7563	2.0651	....	1.1425	1.1425	1.7563	....	1.4899	1.1966
Sept. 3..									
R.....	2.8448	3.4354	....	2.0072	2.3932	2.8564	....	1.4899	....
L.....	1.9230	2.1616	....	1.3975	1.9300	2.2388	....	....	....
Sept. 4..									
R.....	....	2.0265	2.2233	....	2.4704	2.4158	2.8718	....	....
L.....	....	1.6096	1.5219	....	1.6119	1.9495	2.2233	....	....

SUMMARY OF CONCLUSIONS.

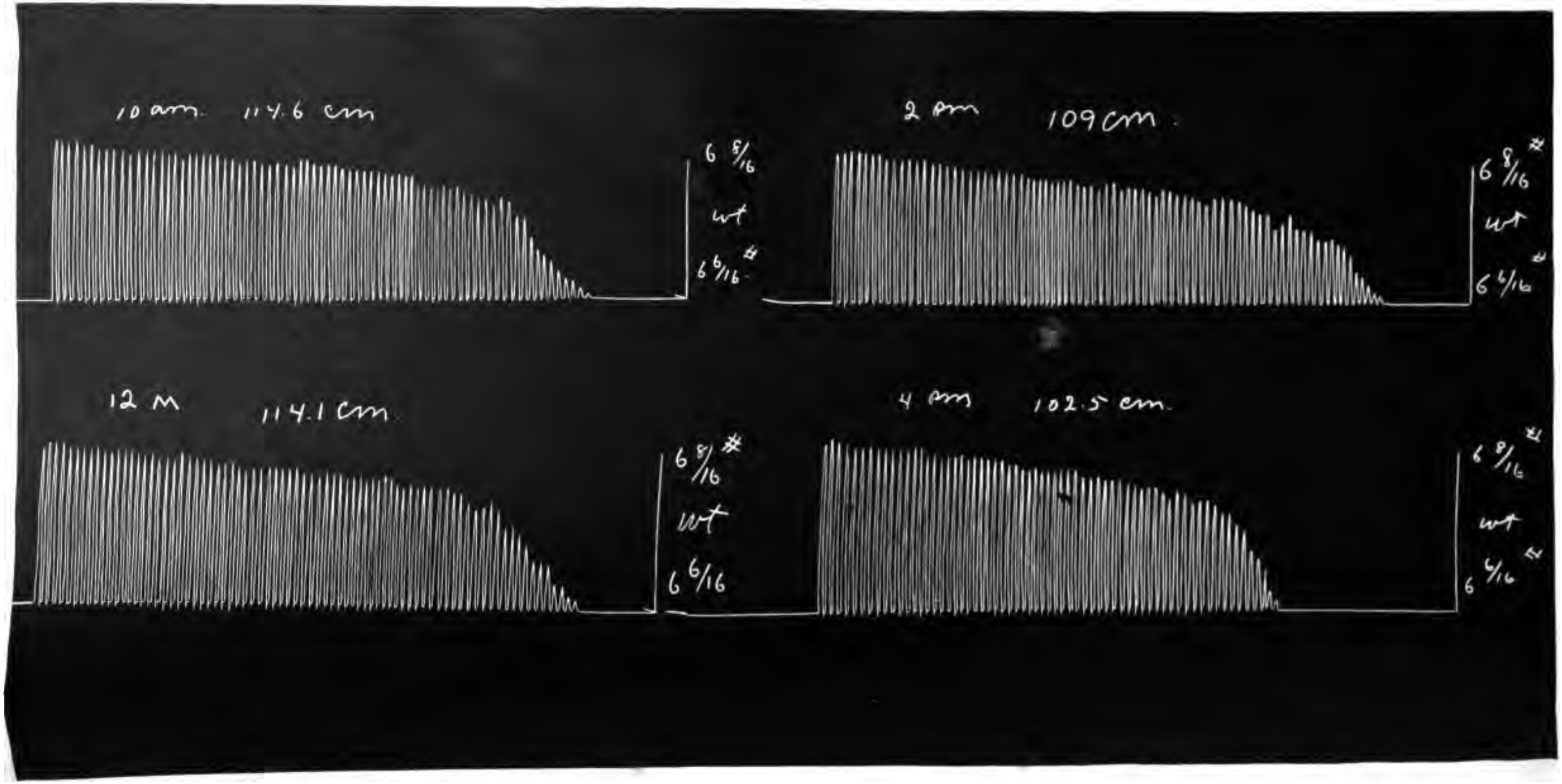
This investigation has produced evidence to show that, in the writer's case,

1. Mental or muscular work producing partial fatigue,—i.e., not exhaustion—reduces the power of voluntary muscular contraction.
2. Sleep and food restore the ability to do work.
3. The power of voluntary muscular contraction is directly influenced by bodily health.
4. Exercise has an immediate and stimulating influence upon the power of contraction. (This influence is not to be confused with that which comes as a result of a season of training. This latter influence was apparent in these experiments, but it is such a well known result of exercise that no other note than this is made of it here.)
5. There is no harmony between the daily variation in the pulse rate and the daily variation in voluntary muscular power.
6. Increase in the respiratory rate has a decided and almost instant influence, an increase in the rate producing an increase in the ability to do work.
7. Ordinary variations in temperature have no perceptible effect.
8. Under fairly constant conditions not of a fatiguing nature

during the month of August, 1899, at the age of twenty-four, there was apparently a daily variation in the power of voluntary muscular contraction shown by the deep flexor muscles of the forearm. This variation consisted of a morning rise in power lasting until ten or eleven o'clock; then a fall lasting until noon; an afternoon rise until the neighborhood of four o'clock; and then a fall in power which was evident at six in the evening.



Some typical curves of daily variation in muscular power. The first five were made with a weight of 3-4 kilos. The last with a weight of 3-8 kilos. The figures on the left indicate the height in centimeters to which the weight was lifted. The figures above indicate the hours at which the experiments were made.



Type of fatigue curves produced.

LITERATURE.

There is not a great deal of literature bearing upon the chief phase of this paper. Mosso (12) and Maggiora (10) produced results bearing upon the influence of food, fasting, sleep and lack of sleep, and mental and physical fatigue, which are factors that must be considered in any study of the causes of daily variation in neuro-muscular power. As is well known, these investigators found that food and sleep have an influence favorable to the production of voluntary muscular work, while fasting, sleeplessness, and mental or physical fatigue lessen such ability. They did not concern themselves with the normal daily rhythm in voluntary muscular power.

The investigation of Lombard (7) bears directly upon this subject. The results of his research indicate that in his case there was a normal daily rhythm in power consisting of a morning rise lasting until ten or eleven o'clock, then a lessening in power until noon. Early in the afternoon another rise was evident, being most apparent in the neighborhood of two or three o'clock. This was followed by a sudden fall in power, four p.m. being ordinarily a time of minimum muscular power. Finally an early evening rise in power was evident at five or six o'clock. Lombard's observations were continued throughout the night, and his curve of daily variation was made to include the whole twenty-four hours. The writer's experiments were discontinued at six p.m. Lombard's paper further verifies the conclusions offered by Mosso and Maggiora bearing upon the influence of food, fatigue of the day, and rest. In addition, he finds a high temperature united with great humidity, smoking, and a sudden lowering of atmospheric pressure to be factors which go to reduce neuro-muscular power; alcohol in small amounts and a sudden increase in atmospheric pressure are factors which increase such power.

Harley (3) states that his curve of daily variation is like that found by Lombard. His investigation was concerned chiefly with the influence of sugar and smoking.

Kraeplin (5) finds an increase in muscular power for three or four hours after each meal.

It will be observed on reading the conclusions presented on page 206 that the writer's daily variation in voluntary muscular power presents the same characteristic features that are apparent in the curves of variation outlined by the above investigators. That individual differences should appear is to be expected; the wonder is that these differences are not greater. Lombard's forenoon variation is almost identical with that of the writer. His afternoon variation presents the same characteristic features as that of the writer, the changes being of shorter duration in Lombard's curves. His afternoon rise was accomplished by two or three o'clock; the writer's, by three or four. The same relation may be seen in the period of lessening power which follows.

The investigations of Treves (15), of Hough (4), and of Franz (1) unite in showing that the ordinary, isotonic, ergographic fatigue curve does not represent all the working power of the muscles employed. After the muscles are apparently unable to work longer with a certain resistance, they are still able to do enormously more work with lessened resistances. For this reason these investigators criticise much of the work that has been done with that method, holding that the fatigue curve so gained does not represent the true condition of the muscles.

The writer has used that method here because he feels that it is not necessary in such investigations as these to find the absolute value of the power potential in the muscle groups involved. These investigations are made in order to determine the normal daily variations in the normal working ability of certain muscles. Now, the every day experience of our voluntary muscles deals with the same kind of fatigue that comes in the ordinary ergographic experiment such as forms the basis of this investigation. At its greatest, this amount of fatigue is only that which is sufficient to make further voluntary work impossible or exceedingly irksome under the conditions of daily life, or under the experimental conditions which gave rise to that fatigue. Under very extraordinary conditions, or under more favorable conditions, a great deal more work can be accomplished by such partially fatigued muscles, but all—absolutely all—the muscular power is never expended. At least such an expenditure could never occur under anything like normal conditions, and those are the conditions with which we wish to deal.

The ordinary isotonic fatigue curve represents, under the experimental conditions then obtaining, the then normal available working power of the muscle group or groups producing it; and, in the hands of a skillful observer, such records may be used legitimately as samples of the condition of the voluntary neuromuscular machines which carry out our daily program of physical labor.

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THE FOOT IN GYMNASTICS.

HENRY LING TAYLOR, M.D.

Signs are not wanting that a deep sense of the worth and beauty of the body, largely lost through many centuries, is again taking possession of the minds of men. The body as a changing, efficient and beautiful organism is being studied with appreciation, one might almost say with affection, by physicians, artists, and men of science; and in conformity with a recent movement in thought, it is being studied as a whole and synthetically.

This paper aims to present the results of recent investigations on the structure and functions of the foot in a form which may be of practical use, both in the care of the foot and in the movements and postures of the body. Largely through a mistaken notion of the unworthiness of the body, it has long been concealed, neglected and abused, and false standards of form and function have become prevalent even among those who have studied and depicted it. "Is then the garment of the soul, its very mould and image, so shameful?" The work of the early masters of the Renaissance, when they began to paint and carve the nude, reveals their evident embarrassment in attempting to depict what they had practically never seen, or seen only with a certain shamefacedness, and correct ideas of form were slowly and painfully evolved. This is especially true of the foot. From that day to the present time, artists and even anatomists, have not hesitated to depict as normal and beautiful the degenerate foot of civilized life, deformed by its coverings, weakened by its cramped and narrow activities. The normal shape and use of the foot, and with them the appreciation of correct form and function, are in great measure lost. As a matter of fact the principal attention we bestow upon the feet is to conceal them with stiff coverings of conventional form. David Copperfield manifested his tenderness for Dora by wearing straw colored gloves and laying the foundation for a beautiful crop of corns. "If the boots I wore at that period," he says, "could only be produced and compared with the natural size of my feet, they would show the state of my heart in a most affecting manner." "My boots might be placed in any collection of instruments of torture." The world before and since Copperfield has persisted in cramping the feet in a misguided effort to please.

In order to study the unspoiled foot one must go to infants, savages, and classic sculpture, and strange to say, to cripples, who have never worn shoes. Any excellence may more easily be found in a model than a normal foot, and we must adjust our practice to the fact that all shoe-wearing feet are more or less deformed. Would that we had "gods of strength" to whom we might pray for strong feet, as do the Japanese jinrikisha men.

The skeleton of the foot consists of the bones of the tarsus, metatarsus, and phalanges, twenty-six in all. They are so shaped, placed, and bound together as to make the foot narrow and rigid at the heel, broad, elastic, and somewhat arched across the ball. The foot is markedly arched from behind forward, but much more on the inner side, where it is also more yielding. Broadly speaking, the outer and back parts of the sole are rigid, the front and inner parts adjustable and elastic. Antero-posterior motion at the ankle joint is from 60 to 80 degrees, and there is three times as much below as above the right angle; there is also a small amount of lateral motion. The function of the foot extensors is mainly to raise the forefoot in walking so that the toes may not drag. The large flexors of the calf do the heavy lifting and pushing, and are three times as strong as all the other ankle muscles, and five times as strong as the extensors. Lateral motion is slight at the medio-tarsal joint, but twice as great as the subastragoloid and amounts to 45 degrees. Abduction, when considerable, is combined with outward tilting of the sole, or eversion, and the compound movement may be called pronation; in extreme pronation the forefoot is lifted. Adduction, when considerable, is combined with inward tilting of the sole, or inversion, and the compound movement may be called supination; in extreme supination the forefoot is dropped.

The toes in an infant move almost as freely as fingers, the large toe is somewhat thumblike and turns freely inward; in fact, the foot shows more than traces of prehensile ancestry. It is a grasping as well as a supporting organ, and in many tribes of men the feet are used like hands. The writer has seen Japanese cabinet makers, seated on a mat, hold and shift their material with their toes. Individuals deprived of the use of the hands sometimes develop extraordinary dexterity in the use of the feet, and have been able to draw, paint, play on musical instruments, and perform other surprising feats. In certain positions taken by athletes the toe grasps the ground, as may be seen in the statue of the discobolus, or in a starting sprinter. On the other hand, the feet of many modern "strong men" are weak, degenerate, deformed, and their gait stiff and awkward. They have impaired the main functions of the foot, which are support and propulsion.

The foot may be considered as to its form, as to its posture and relations to the leg and trunk, and as to its functions.

In the unspoiled foot, as seen in children or savages who have never worn shoes, the heel is narrow and rigid; the front, broad and elastic, and the metatarsal bones bearing the toes spread out like the sticks of a fan, each toe while at rest lying as straight and separate as a finger. The inner edge of the foot looked at from above forms a perfectly straight line from heel to toe; but looked at from the inner side it forms a graceful and elastic arch; the outer edge of the foot is much less arched and more rigid, bearing with the heel and ball practically all the weight, as shown by a study of footprints. The heads of the metatarsals form a transverse arch which widens when weight is put upon it. Such a normal foot is often called a straight foot because it is characterized by a straight inner border, while in nearly all shoewearing feet the great toe is bent toward the middle line of the foot.

The posture of the foot is straight, without regard to its shape, when the inner border of the foot is parallel to the median vertical plane of the body. It is that posture of the foot, when it is rotated neither outward nor inward, but points straight ahead. In this straight posture the foot must bear certain relations to the leg in order to be normal. In particular, the heel bone must stand upright under the tibia, and not tilt to one side, and the forefoot must not be abducted nor everted, except momentarily and to a moderate degree, as the result of bearing the weight of the body. As weight is thrown upon a straight foot, the inner ankle becomes prominent, sinks, and moves backward, the arches are depressed and elongated. The scaphoid becomes prominent; the foot yields on its inner and weaker side, and being prevented from turning outward the limb rotates inward at the hip joint. When the weight is removed the elasticity of the foot brings it back to its natural shape and posture. It is when there is a disparity between the weight and the strength and elasticity of the foot that the everted posture temporarily assumed under normal conditions of work becomes permanently impressed upon the foot, which becomes then, in relation to the leg, abducted and everted; it is then a weakened foot and may become a more or less rigid and painful flatfoot. In this condition, when the leg looks directly forward, the foot points outward and forward; in other words, the individual toes out.

Practically the most important points to bear in mind are the facts that abduction and eversion are fused into one compound movement which is favored by outward rotation, and that the outward posture is an indication of and favors weakness, while the straight or slightly inward posture indicates and favors strength and efficiency.

In discussing foot postures, it is necessary to draw a sharp distinction between the foot in action, the working foot, and the passive or resting foot. When the body rests supported on one foot, that foot is working, and should always be straight. This active leg is called the "Standbein" by the Germans. The passive or resting leg, called the "Spielbein," may be placed forward, to the side, or backward, and may be rotated out without harm to structure or correctness of pose; but when it in turn receives the weight and becomes the "Standbein," the foot should be directed forward in order properly to distribute the strain. In the pronated and outtoeing foot, the strain is thrown upon the ligaments, as in the hyper-extended knee, the overtilted pelvis, the rounded back. In the straight or intoeing posture, the muscles are brought into play and the ligaments are relieved of strain. Speaking broadly, when it is proper to put strain upon the ligaments, the outtoeing posture is proper; under other circumstances it is incorrect. The relaxed or outtoeing position favors and accompanies bodily relaxation. Children with habitual faulty attitudes of the trunk usually have weak ankles and outtoeing feet; on the other hand, individuals who are strong, lithe, and erect, like runners, hunters, mountaineers, woodsmen, and those habituated to carrying burdens upon the head, will be found to use the straight or inverted foot.

The Anglo-Indian wizard thus describes the gait of a mountaineer: "This is my country, said the lama, and with steady, driving strokes from the loins he strode upward."

Loti says: "Et de mes pas rapides de montagnard, â longues enjambées nerveuses."

Roberts thus describes the hunter's going: "And he swung off with long, active strides down the trail."

Kennan observes that in Martinique "you cannot go a mile on any country road without meeting at least one line of straight, vigorous, barefooted women, walking swiftly with a long, free, swinging stride, and balancing without effort on their heads loads weighing from fifty to eighty pounds." He remarks that "the habit of carrying heavy loads for hours at a time on their heads has given them a superb erectness and grace of figure together with an elasticity of step and a freedom of movement that I have never seen equalled." These are not descriptions of the inelastic, outtoeing heel gait, but of the springy heel and toe straight-foot gait.*

Unfortunately this is not the kind of physique that is presented as material to the physical trainer, the artist, and the physician. We see the degenerate foot of civilized life, weakened, strained, or broken down by overweighting or monotonous use, and cramped by shoes. It is to be noted that unrelieved standing is, perhaps, the most important cause of flatfoot, while, as Hoffman remarks, it is never caused by correct walking. This affection is most common among those who habitually stand or loiter, rather than among those who walk or move actively. The weak, inelastic foot of civilized life is only a part of a general weakness, evident in faulty postures of the head and trunk and often of the entire figure. When such individuals walk, climb, or run, their weak and everted feet shift the weight to the heels, giving them a stiff and awkward gait.

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* Greek sculpture of the best period, depicting a generalized type, a sort of composite of the best examples of form, always shows the straight, weight-bearing foot. In later times, in proportion as the type and the art had degenerated, the outturning toe became more common and pronounced.

Weak feet are not only an expression of general atony, but directly tend to produce faulty attitudes. It is easy to see how the everted foot throws undue strain upon the inner side of the knee, favoring knock-knee, and the two conditions are often associated, though the weak ankled child sometimes instinctively inverts the feet to relieve the strain on knees or ankles, a protective manœuvre which should be respected. It is the writer's belief that the weak and everted foot also has a malign effect upon the poise of the pelvis and spine, and that in fact under its influence the whole posture deteriorates.

Let us consider the first gymnastic standing posture in the light of the foregoing, a posture used as a norm, largely for descriptive purposes, or as a point of departure, but which has nevertheless exerted an unhappy influence on gymnastic postures and movements, and even, it is to be feared, on posture and carriage generally. This posture is the well-known one, with body erect, head facing forwards, the arms at the sides, the knees straight, the heels together, and the inner borders of the feet making an angle open forwards of from 60 to 90 degrees according to the Swedes, Germans, and military authorities. This position is assumed only to be departed from, but the harmful eversion of the feet follows persistently through subsequent movements, operating mischievously on posture, poise, and movement. The anatomical and artistic first position, it is interesting to note, is often depicted in special treatises with closed feet. The gymnastic first position is one never naturally assumed; indeed, a symmetrical posture with a symmetrical distribution of weight is the one which most easily fatigues and overstrains and which least subserves any practical purpose, and should rarely be retained as a basis for arm movements, for instance. Right and left alternation, as in progression, where one side rests while the other works, should be more largely employed. For example, the weight may be borne on the forward straight foot during arm movements, and shifted from right to left at intervals. It is an error to carry forward the posture of symmetrical quiescence into subsequent activity. We have, I fear, been doing much of our gymnastic thinking from the basis of a symmetrical wooden figure with spread toes as a basis. Let us substitute the type shown in the Apollo, or the dorphorus of classic sculpture, with the weight resting on the forward straight foot. Not only will the foot be protected and strengthened, but the general posture will be favorably affected.

It is not difficult to find gymnastic classes where drills are executed with the head and abdomen poked forward, the chest flat, back hollow, knees sprung back and feet everted, without grace of carriage or correctness of movement, and where the faulty attitudes brought to the drill are as often exaggerated as improved.

It is surely not surprising that methods showing no better results do not win an enthusiastic endorsement either from educators or the general public. Nor is it to be expected that the simple expedient of turning the feet inward should remedy such fundamental evils. What is needed is a cultivated sense of the beautiful and effective in posture—the two will be found to coincide—and a careful review of gymnastic movements from this point of view. The expert workman, the wild animal, instinctively shun the ugly in pose and movement for the simple reason that beauty of line and grace of movement mean efficiency and economy of force. Watch an expert axeman at work, observe the play of young children and young animals, study their poses, outlines, and movement; the wild beasts "kill in curves;" ugliness has been eliminated because it spells inefficiency. It must also die in the gymnasium, if gymnastic training is to become wholesome, vigorous and uplifting. Only, the appeal must be to an enlightened taste, not to the taste which considers deformity beautiful. Let the beginning and end of each movement be a definite posture which shall satisfy an enlightened hygienic, physiologic, and artistic sense.

Not only for the sake of the feet but for the sake of the whole body a flexible, flat gymnastic slipper of correct shape and ample size should be provided. This should be broad in front, narrow behind, and straight on the inner side. Special attention should be paid to the posture in which the foot receives the weight, as already indicated. As forward propulsion is far the most important active function of the foot, the forward straight foot should be the standard, to be departed from only for special reasons in certain exercises, especially those which bring lateral trunk action into prominence. The weight should be frequently shifted from one side to the other. Besides this, special exercises should be introduced which directly tend to strengthen the foot on its inner and vulnerable side, and to prevent deformity. Such movements are adduction and inversion of the feet, and ankle flexion, as in heel raising with the feet adducted.

If the facts and deductions here presented are correct, gymnastic exercises require examination and readjustment from the standpoint of posture.

The everted foot is the legacy of the fashion plate, the shoemaker, the dancing master, and the drill sergeant. It indicates indolence, weakness, affectation and degeneracy, and as the dominant note of a system it should be abolished. By taking pains correct shoes may be obtained. Straight foot dancing is now successfully taught, and military experts are beginning to doubt the utility of the parade posture and parade step.

When physical trainers, perceiving the instability of its foundations, abandon the outtoeing posture, their art will gain in grace, efficiency, and power.

REPORTS FROM SOCIETIES.

CINCINNATI PHYSICAL EDUCATION SOCIETY.

The Cincinnati Physical Education Society held its first meeting on Thursday, October 16th, in the Second Intermediate School. A majority of the members were present. After the transaction of the business in hand, an excellent paper was read by Dr. E. A. Pors on "Personal Hygiene." An enthusiastic discussion followed, and the meeting adjourned to meet on November 14th.

The November meeting was held on Friday, the 14th. Business was transacted and suggestions offered for future discussions. Dr. Carl Ziegler read a paper on "The relative value of various exercises," which called forth an interesting discussion. The next meeting will be held in December.

ADELAIDE SPILLS, *Secretary.*

SOUTHERN MICHIGAN PHYSICAL EDUCATION SOCIETY.

The Southern Michigan Physical Education Society met in Ann Arbor on November 1st, the session being held in the Barbour Gymnasium.

The opening paper was given by the president, W. P. Bowen, of Ann Arbor; subject: "Studies of the pulse and breathing as influenced by muscular work." The writer has spent much time in research work along this line and some of the results were set forth in this paper. By request Mr. Bowen will read the paper before the national association in April.

Miss M. P. Clough read a paper on "Physical education and the twentieth century in the United States."

A business meeting followed and plans were discussed for the coming national convention, final settlement being left for the Executive Committee. The Executive Committee was also authorized to present suggestions for the rearrangement of our by-laws to meet new conditions which have arisen.

Miss Blair, of Ann Arbor, was elected to membership, and the name of Miss Chase, of Ann Arbor, proposed.

On motion, the officers of the preceding year were re-elected, with the exception of the Treasurer, who wished to withdraw. The following are the officers for the ensuing year: Pres., W. P. Bowen, Ann Arbor; 1st Vice-Pres., Dr. Alice Snyder, Ann Arbor; 2d Vice Pres., B. Seiffert, Detroit; Sec., Mrs. Fannie Cheever Burton, Ypsilanti; Treas., Miss M. P. Clough, Detroit.

The adjournment was followed by an exhibition of triple tumbling in the gymnasium by Messrs. Toney, Whitlock, and Wieland, of the University of Michigan gymnasium team.

FANNIE CHEEVER BURTON, Secretary.

REPORTS OF THE COUNCIL.

October 4, 1902—Present: Drs. Savage and Gulick, Mr. Haug, and Miss Bancroft.

The minutes of the previous meeting were read and approved.

The following new members were elected: Lora E. Merrill, Kenosha, Wis.; Dr. Jacob Rettich, Cincinnati, Ohio; Perry J. Stephens, East Liverpool, Ohio; Dr. Thomas A. Storey, Boston, Mass.; George Wittich, Milwaukee, Wis.; Grace Whitaker, Tyngsborough, Mass.

The resignation of Mr. Jakob Bolin from the National Council was read and accepted with keen regret. The Secretary was instructed to so inform Mr. Bolin.

The Secretary reported that the Cincinnati, Ohio, Physical Education Society had been reorganized, and that the Syracuse Physical Education Society is reported by its Secretary as disbanded.

The report of the Treasurer, showing $171.55 on hand, was read.

The Editor of the REVIEW reported that the March and June numbers for 1902 would be issued in a week, and that he expects by December to have the magazine up to schedule time.

The Chairman of the Finance Committee reported continued efforts to secure advertising for the REVIEW.

The Committee on Convention reported that the Southern Michigan Physical Education Society had voted favorably to holding the convention in that State in the spring of 1903. The Council voted to accept this invitation.

The appointment of a successor to Mr. Bolin as a member of the National Council was postponed till the next meeting.

A Committee on Extension was appointed consisting of Mr. Haug, Chairman, Miss Beiderhase, Mr. Hillyer, and Mr. Hepbron.

A Committee on Constitution was appointed consisting of Dr. Taylor, Chairman, and two members to be appointed by him. This committee was instructed to present for discussion at the next meeting a draft of a constitution.

Upon motion the Council adjourned.

JESSIE H. BANCROFT, Secretary.

November 1, 1902—Present: Drs. Savage, Taylor, and Gulick, Messrs. Haug and Hillyer, Miss Beiderhase, and Miss Bancroft.

The minutes of the previous meeting were read and approved.

The following persons were elected to membership in the Association: Maria Grey, Milwaukee, Wis.; Mary Palache, Berkeley, Cal.; Guido Werner, Cincinnati, Ohio.

The Secretary's report was received and approved.

The report of the Treasurer, showing $57.68 on hand, was received and accepted.

The Editor of the REVIEW reported that the September and December numbers would be issued at the same time, probably in December. The report was approved.

Dr. Taylor moved that Mr. J. Blake Hillyer be elected to fill the vacancy in the Council caused by the resignation of Mr. Bolin. Mr. Hillyer was unanimously elected.

Mr. Haug moved that, in view of the important work in the hands of the Extension Committee, the Council be enlarged by one, and nominated Mr. George T. Hepbron for this position. The resolution was accepted and Mr. Hepbron was unanimously elected.

The report of the Committee on Constitution was received. The chairman, Dr. Taylor, reported that in accordance with the power conferred upon him by the Council, he had appointed Dr. Savage and Dr. Gulick members of the Committee. The draft of a proposed constitution was read, considered, accepted as to its main features, and referred back to the Committee for elaboration.

The Committee on Extension reported through its chairman, Mr. Haug, the draft of a letter to be sent to members of the Association. It was received, accepted, and referred back to the Committee with power.

On motion the Council adjourned.

JESSIE H. BANCROFT, Secretary.

November 22, 1902—Present: Drs. Savage and Taylor, Messrs. Hillyer and Hepbron, Miss MacMartin, Miss Beiderhase, and Miss Bancroft.

The report of the Secretary was received.

The Treasurer reported bills payable to the amount of $324.78; cash on hand, $49.68; and bills receivable $553.00. The financial condition of the Association was discussed and, as the bills receivable were not at once available, members of the Council volunteered to advance funds to meet immediate needs.

The following were elected to membership: William Y. Reithard, Evanston, Ill.; Genevieve Cook, San Francisco, Cal.

A report of the Southern Michigan Physical Education Society relative to the coming convention was read, discussed, and approved.

Upon motion the Council adjourned.

JESSIE H. BANCROFT, Secretary.

OFFICIAL ANNOUNCEMENTS.

"The report of the Committee on Constitution was presented by Dr. Gulick in the absence of the chairman. A final draft of the constitution was read, discussed, and adopted, to go into effect March 1, 1903, unless, before that date, a majority of the members of the Association send a protest to the Secretary of the National Council. The Editor of the REVIEW was instructed to publish this constitution in the December, 1902, number of the REVIEW."—(Extract from the minutes of the December meeting of the National Council.)

A proposed constitution of the Association is herewith offered. It is in accordance with the articles adopted by the last convention. In this constitution the following objects have been sought:

1. Simplicity and clearness. To accomplish this each subject has been made complete in itself; thus, under the head of *Council* complete directions for the Council are found, and under the head of *Local Societies* complete directions for local societies are found. This involves some repetition, but adds clearness.
2. To make a constitution which shall allow (a) elasticity of practice, (b) government largely by precedents, and (c) the meeting of local and temporary exigencies.
3. To grant very great local and sectional autonomy, and to encourage local societies. Local societies may thus have members who are not members of the national Association, but such persons do not receive the REVIEW.
4. To make the National Council a thoroughly representative body. To this end it includes representation from all local societies having a national membership of at least ten. It is thus representative geographically. It is representative of special interests through the presidents of sections. Its efficiency in doing business is guaranteed by a local quorum. No one local society is given commanding position in influencing the composition or policy of the National Council.

NAME.

ARTICLE 1. This body shall be called The American Physical Education Association.

OBJECTS.

ART. 2. The objects of this Association shall be to awaken a wider and more intelligent interest in physical education; to acquire and disseminate knowledge concerning it; and to labor for the improvement and extension of gymnastics, games, and athletics.

MEMBERSHIP.

ART. 3. The Association shall consist of members and honorary members.

ART. 4. Any person may become a member of the Association upon recommendation by two members or by a local society, election by the Council, and the payment of an initiation fee and one year's dues.

ART. 5. There shall be an initiation fee of one dollar.

ART. 6. The annual fee for membership shall be two dollars. The PHYSICAL EDUCATION REVIEW shall be sent gratis to all paid-up members.

ART. 7. The dues shall be for the calendar year designated by the applicant.

ART. 8. Honorary members shall be nominated by the Council and elected by a two-thirds vote of the members present at a national convention.

ART. 9. Any member who fails to pay dues for two years shall thereby forfeit membership in the Association provided that two notices of indebtedness, at an interval of at least three months, shall have been given. Such person may be restored to membership only upon payment of arrearages or upon re-election and a payment of initiation fee and one year's dues.

COUNCIL.

ART. 10. The government of the Association, except where otherwise provided by the constitution, shall be vested in a national Council. The Council shall be composed as follows:

1. The Presidents of active local societies having ten members in the national society.
2. The Presidents of all sections.
3. The President of the preceding council.
4. The Editor of THE PHYSICAL EDUCATION REVIEW.
5. Enough additional persons to make a constant working body of nine in the territory in which the national Council has its headquarters. These additional persons shall be elected by the local society of said territory and shall be members of this local and of the national societies.

ART. 11. The officers of the Council shall be a president, a vice-president from each section, a secretary, and a treasurer. Vice-presidents shall rank in the order of the age in membership in the national Association.

ART. 12. The Council shall elect its own president, secretary, treasurer, and editor.

ART. 13. The Council and its officers shall be elected for a term of two years.

ART. 14. The Council shall fill any vacancies that may occur in its own body.

ART. 15. The Council shall appoint its own committees and manage all the affairs of the Association under the constitution.

ART. 16. Four members of the Council shall be a quorum for the transaction of business.

ART. 17. The Council shall arrange for the holding of a national convention at least biennially.

ART. 18. The president, or, in his absence, the senior vice-president present, shall preside at national conventions of the Association and at meetings of the Council. It shall be the duty of the president to give an address at the national convention of the Association over which he presides.

ART. 19. The vice-presidents shall be chairmen of their respective sections. It shall be the duty of each vice-president to give an address before his own section at the annual convention.

ART. 20. The Council may, by a three-fourths vote, establish or discontinue the affiliation of a section with the national Association.

ART. 21. The Council may, by a three-fourths vote, establish or discontinue the affiliation of a local society with the national convention.

ART. 22. The national secretary shall annually send one dollar to the secretary of each active and affiliated local society for each paid up member of the national Association who is also a member of said local society.

SECTIONS.

ART. 23. Members of the national Association who organize in the interests of some particular department or phase of physical education, irrespective of geographical lines, may become a section of the national Association upon election by the national Council.

ART. 24. Sections may be affiliated, or their affiliation canceled, by a three-fourths vote of the national Council.

ART. 25. Only members in good standing in the national Association shall be eligible to membership in any section. Membership in the section may continue only so long as the member remains in good standing in the national body.

ART. 26. Each section shall elect its own members, officers and committees; fix its own dues; and otherwise manage its own affairs so long as the general constitution of the national Association be not violated. Proceedings shall be reported to the national Council for publication in the REVIEW.

ART. 27. The presidents of sections having ten or more members shall be ex officio members and vice-presidents of the national Council. Their rank as vice-presidents shall be in the order of seniority of membership in the national society.

ART. 28. Each section shall hold a meeting in connection with each national convention.

LOCAL SOCIETIES.

ART. 29. Members of the national Association who represent a limited territory and who organize for the general interests of physical education, provided they meet the conditions of an active local society, may become affiliated with the national Association as a local society upon election by the national Council.

ART. 30. Local societies may be affiliated with the national Association, or their affiliation cancelled, by a three-fourths vote of the national Council.

ART. 31. Local societies which hold at least four meetings during each year, and report the same to the national Council for publication in the REVIEW, shall be known as active societies. They shall receive from the national Council one dollar for that year for each member of the local society who is a paid up member of the national Association.

ART. 32. Each local society shall elect its own members, officers, committees, fix its own dues, and otherwise manage its own affairs so long as the general constitution of the national Association be not violated. It is not necessary that members of local societies be members of the national Association. Only national members shall be entitled to the REVIEW gratis.

ART. 33. The presidents of active local societies having ten or more members who are members of the national Association shall be ex officio members of the national Council.

CONVENTION.

ART. 34. The Council shall arrange for the holding of a national convention at least biennially.

ART. 35. Conventions shall be managed by a local society approved by, and under the direction of, the national Council.

Art. 36. The president, or, in his absence, the senior vice-president present, shall preside at national conventions of the Association. It shall be the duty of the president to give an address at the national convention over which he presides.

Art. 37. The convention shall include meetings of all sections.

Art. 38. The presidents of sections shall preside as chairmen and deliver an address at the meeting of their respective sections at the national convention.

Art. 39. When assembled in national convention the Association shall determine the headquarters of the national Council.

Art. 40. When assembled in national convention the Association may amend any part of the constitution by a three-fourths vote of the members present, provided notice of such change shall have been given in writing at the preceding national convention of the Association.

PHYSICAL EDUCATION REVIEW.

Art. 41. The national Association shall publish a journal to be known as The American Physical Education Review.

Art. 42. The subscription price of the Review shall be two dollars per annum.

Art. 43. The Review shall be sent free to all paid up members of the national Association.

Art. 44. The Review shall be the official organ of the Association, and in it shall be printed the proceedings of the national Council and of all active and affiliated sections and local societies.

Art. 45. The Editor of the Review shall be elected by the national Council.

Art. 46. The Editor shall be ex officio a member of the national Council.

To the Editor of Physical Education Review:

Dear Sir:—The National Council of the A. A. A. P. E. has appointed me a committee to whom may be referred all matters relating to transportation of members of the A. A. A. P. E. from the East to Detroit for the convention of the Association April 6-8, 1903.

I am in communication with the Trunk Line Association and others directly concerned in these arrangements. They assure me of a "one and one-third" rate for all delegates from all directions, provided the number of delegates (and others purchasing tickets through delegates) from all directions outside of Detroit purchasing tickets to Detroit for the convention shall equal one hundred. Full rate tickets must be procured to Detroit, and one-third tickets may be obtained for the return trip on presentation of certificates endorsed by officers of the Association.

A committee on transportation has doubtless been appointed by the Michigan Society. That committee should be notified personally by each member of the Association, and the March number of the Review should contain a report from that committee stating whether or not one hundred or more tickets will be required, and the reduced rates secured. I shall be glad to do what I can to assist the Michigan committee from this part of the field.

Should twenty-five or more delegates go from New England, Eastern New York, New Jersey, and Pennsylvania, I would advise securing special cars, a matter which may be arranged at a slight advance on ordinary sleeping car rates, so that all may go together under the pleasantest conditions.

Respectfully,

J. Blake Hillyer,
Committee on Transportation.

EDITORIAL NOTE AND COMMENT.

THE CONVENTION.

The conventions of our Association have, with one exception, been held in the East: Boston, New Haven, Philadelphia and New York. The one exception was the convention held in connection with the National Education Association during the year of the World's Fair, when we met in Chicago.

It is fortunate, therefore, that the Council is able, this year, to accept an invitation from the central part of the country. Michigan is not so far west as to be inaccessible from the east, and yet it is far enough west to enable many persons to attend who do not usually come to the east. The western membership in our Association is growing rapidly, and much progress is being made in the central and western states in physical training. Having the convention in Michigan should result in the development of a number of new and strong speakers and workers on our subjects, speakers and workers who have never been prominent in our conventions. In this way the Society will gain in breadth and new life. We are to be congratulated upon having a western Society of sufficient strength and courage and altruism to undertake the management of the convention.

LOCAL SOCIETY ORGANIZATION.

We frequently get inquiries as to how local societies should be organized. The following suggestions are made on the basis of experience:

1. The person who is interested should secure from the Secretary of the National Council a revised list of the members of the National Society who reside in the district where it is proposed to organize the local society.
2. From this list and from personal acquaintance from three to six people should be selected who would be interested in the project.
3. They should come together for a preliminary meeting. At this preliminary meeting they should read through carefully the section of the National Constitution dealing with local societies. This meeting should prepare a simple constitution to present to the meeting for organization later; the simpler and more elastic the constitution the better. It should provide for election of officers, and for local dues in addition to those which will be received from the National Society (if it is desired to have such).

4. They should issue a call for a meeting for organization to all persons interested in their territory. Specific invitations should be sent to persons in the district who are members of the National Society.

It would be well at this meeting for organization, in addition to business, to have an address by some well-known person connected with physical training whose name will be useful in helping to draw together persons interested in the subject. This meeting should revise and adopt the constitution; should elect officers; the officers should arrange for a series of meetings to be held during the year, and should apply for recognition to the National Society.

Addresses of the following named persons are desired by the Secretary, Miss Jessie H. Bancroft, 80 Joralemon St., Brooklyn, N. Y.:

Miss Mollie Benton, Prof. M. R. Ely, Miss Mary S. Haagenson, Miss Linda Haines, Miss Mary H. Hall, Charles Kimble, Miss Florence H. Marston, Miss Lucy W. Robinson, J. F. Rogers, Miss Maude A. Wessel.

NEWS NOTES.

At a meeting of physical directors of secondary schools held at Chautauqua, N. Y., July 26, 1902, *The Society of Secondary School Physical Directors* was organized. The officers elected were:

President, E. B. DeGroot, Lewis Institute, Chicago.
1st Vice-Pres., Lory Prentiss, Lawrenceville School, Lawrenceville, N. J.
2nd Vice-Pres., M. F. Sweeney, The Hill School, Pottstown, Pa.
Secretary, O. F. Monahan, The Hotchkiss School, Lakeville, Conn.
Treasurer, H. S. Anderson, University School, Cleveland, Ohio.

The following constitution was adopted:

ARTICLE I.

NAME.

This organization shall be known as The Society of Secondary School Physical Directors.

ARTICLE II.

OBJECTS.

The objects of this society shall be:

SECTION 1. The systematic study of physical training problems peculiar to secondary schools.

SEC. 2. The study of secondary school physical training work in relation to college and university physical training work.

SEC. 3. The dissemination of the results of study and investigation.

ARTICLE III.

MEMBERSHIP.

The members of this society shall be limited to the following men:

SEC. 1. (a) Those who are members of the A. A. A. P. E. in good and regular standing.

(b) Those who are physical directors devoting their entire time to the subject of physical training in secondary schools.

(c) Those who have had at least two years' professional experience in physical training.

SEC. 2. Any member of the society who severs his connection as a physical director of a secondary school forfeits his right to membership in The Society of Secondary School Physical Directors.

ARTICLE IV.

OFFICERS.

The officers of this society shall be a president, two vice-presidents, a secretary, a treasurer, and an executive committee consisting of the officers and two members of the society.

They shall hold office for a period of one year, with the exception of the secretary; and shall be elected by a majority vote of the members present at the annual meeting.

ARTICLE V.

SEC. 1. The annual meeting shall be held in December, and at such a place as the president and secretary may be able to secure.

SEC. 2. A majority of members of the executive committee shall constitute a quorum.

Besides the usual definition of the duties of officers, order of business, etc., the by-laws contain this article:

"The Society initiation fee shall be $5. Annual dues thereafter, $1 per year payable at the annual meeting. Application blanks must be filled out and mailed to the secretary together with a receipt from the A. A. A. P. E. and $5 for entrance fee."

The society will hold its first annual meeting in New York December 30th and 31st.

The following items of interest concerning the North American Turner-Bund are taken from its official organ, the *Amerikanische Turnzeitung*, Milwaukee, Vol. 18, Nos. 14-15 (April 6-November 9, 1902), full Nos. 901-932:

Statistics, January 1, 1902. The Nordamerikanischer Turnerbund (Gymnastic Union) includes 257 societies (Turnvereine), grouped in 28 districts (Turnbezirke). The total membership is 34,708, and out of this number 5,591 are active gymnasts. There are 1,890 members of junior societies, 1,814 in classes for seniors, 4,090 in classes for women, 18,012 boys and 10,099 girls in children's classes, 6,321 in fencing sections, 2,144 in singing, and 690 in dramatic sections; 169 teachers of gymnastics are employed; 230 of the societies are legally incorporated, and 177 have halls and gymnasia of their own. The total value of the property of the Bund is $4,475,950, of which amount $2,705,245 is debt-free. During the previous year four societies, with 249 members, withdrew from the Bund or were suspended, but eight new societies, with 640 members, were added.

National Convention. The 20th National Convention (biennial) was held July 6-9, 1902, in Davenport, Iowa. The Executive Board was authorized to expend $2,000 for the purpose of furthering the objects of the Bund by giving publicity to its work at the St. Louis Exposition and the International Olympic Games at Chicago in 1904. A grant of $250 was voted to the new Germanic Museum in Cambridge, Mass. By a vote of 212 to 154, the proposal to admit women to equal rights and duties with men in the societies was defeated. The Indiana District was unanimously, and for the third time, given the choice of the National Executive Board, the headquarters remaining at Indianapolis. The next National Convention will be held in Pittsburg in 1904, and the quadrennial Turnfest in Indianapolis in 1905. The *Amerikanische Turnzeitung,* under the editorship of Heinrich Huhn, was continued as the organ of the Bund for two years.

New Officers. Delegates from the Indiana District met in South Bend on August 17th and re-elected the old Executive Board, with the exception of one member, who declined to serve again. The Board held its first session September 6th, and organized as follows: President, Hermann Lieber; Vice-President, Robert Nix; Corresponding Secretary, Theo. Stempfel, P. O. Box 166; Recording Secretary, Peter Scherer; Treasurer, Albert Metzger (all these live in Indianapolis); Technical Committee, Hugo Fischer, Heinrich Mösch, Heinrich Suder (Chicago), Curt Toll, and Georg Bonnegut; Committee on Mental Improvement, Robert Nix, Peter Scherer, and Theodor Stempfel; Committee on the Normal School of the Bund (in Milwaukee), C. E. Emmerich, Robert Nix, Philip Rappaport, Theodor Stempfel, and Franklin Bonnegut; Finance Committee, Armin Bohn, Albert Metzger, and Franklin Bonnegut; Judiciary Committee, Friedr. Merz, Philip Rappaport, and Peter Scherer.

Teachers' Convention. Immediately following the National Convention of the Bund, and in the same place, occurred the 16th convention of its teachers of gymnastics, July 9th-11th; 57 men were in attendance. Dr. Hermann Arnold, of New Haven, gave an address on the value and use of tactics. In addition to the discussion of various matters of interest, there was a trolley-ride through Davenport, Moline, and Rock Island, with a visit to their gymnastic societies, and an evening exhibition by the Davenport Turngemeinde; 24 teachers remained for a two-weeks' summer course, which included instruction in fencing, by George Heintz, of the United States Naval Academy; boxing, by Chas. Cobelli, of Chicago; wrestling, by John Boss, of Rock Island; and a series of scientific lectures by Dr. H. Hartung, of Chicago. It was voted to hold the next teachers' convention in Detroit in 1903, and the summer course on Put-in-Bay Island, as formerly, in the early part of July of the same year.

Milwaukee Normal School. The last class to graduate from the Normal School of the Turnerbund entered in the fall of 1897. and completed the course in the summer of 1899. In April of the present year the Executive Board entered into a new agreement with the National German-American Teachers' Seminary and its model school, the German and English Academy, in Milwaukee, in order to secure an improved standing and broader influence for the Normal School, and a closer relation between it and these other schools. The agreement is to remain in force for five years, beginning September 1, 1902. By its terms the Turnerbund is to appoint and maintain at its own expense a Technical Director of the Normal School, who will be the principal instructor in gymnastics in the Normal School, the Teachers' Seminary, and the model school. All other expenses, including instruction, care of buildings, fuel, lights, etc., are borne by the Seminary and the Academy.

The length of the normal course is one year, and all instruction is free. Male applicants must belong to one of the gymnastic societies of the Bund, and young women must be recommended by one of these societies. Depending upon the extent of their previous training and their knowledge of the English and German languages, graduates will receive Diploma B, as teachers of gymnastics in the societies of the Bund and in their schools; Diploma C, as teachers in public and higher schools; or Diploma D, as teachers in any of the foregoing. The instruction given by the Technical Director includes gymnastics, gymnastic nomenclature (both German and English), the construction, arrangement and use of apparatus, principles and methods of gymnastic instruction in Turnvereine and in public and higher schools, history of gymnastics, principles and aims of the North American Turnerbund. The Teachers' Seminary supplies the remaining instruction, in the German language and literature, the English language and literature, anatomy and physiology, medical gymnastics and first aid, pedagogy, outlines of the history of civilization, and singing. Pupils in the Teachers' Seminary will also receive sufficient instruction in gymnastics during the three years of their course to enable them to teach this branch in the public schools.

In August the Executive Board appointed Geo. Wittich, of St. Louis, Technical Director of the Normal School for five years. He graduated from that school in 1882, was teacher of gymnastics in the Washington (D. C.) Turnverein for one year, then with the Dayton Turngemeinde until 1887, and since that date has been teacher in the South St. Louis Turnverein. He has also been in charge of physical training in the public schools of St. Louis, and served for two years as director of the summer courses given in Milwaukee under the auspices of the Bund. The reorganized Normal School opened September 8th with six pupils, five men and one woman, and recently two others, a man and a woman, have been admitted. The school buildings are located at 558-568 Broadway, and the address of the Secretary, Otto P. Just, is 432 Third St., Milwaukee.

Miscellaneous Items. Alvin E. Kindervater, teacher of gymnastics in the Turnverein "St. Louis," has been appointed by the school board to succeed Geo. Wittich as superintendent of physical training in the St. Louis public schools.

Dr. Franz Pfister, the editor of *Mind and Body,* spent part of the spring and summer months on the continent of Europe, visiting his birthplace in the Tyrol, and various cities in Switzerland and Germany. Dr. Robert Nohr acted as editor in his absence.

At the meeting of the National Education Association in Minneapolis last July Dr. H. Hartung, of Chicago, read a paper on the "Requirements of Physical Education for our Public Schools." It appears (in German) in Nos. 32-34 of the *Turnzeitung.*

The Gymnastic instruction in the Military Academy at West Point has been for eighteen years in the hands of Hermann Köhler, who was born in Milwaukee, educated in the schools of that city and in the Normal School of the Turnerbund, and one of the prize-winning American squad which accompanied Georg Brosius to the Fifth National German Turnfest, at Frankfort-on-the-Main, in 1880. For a still longer period Turner Georg Heintz, now in his sixties, has been fencing master at the Annapolis Naval Academy.

F. E. L.

ABSTRACTS.

Intercollegiate Athletics (Ira N. Hollis in the *Atlantic Monthly* for October).—In this article the question as to whether intercollegiate athletics have as yet demonstrated their permanent value as a part of college education is considered. Mr. Hollis believes these sports must be judged finally by their effect on character, and that if they teach self-control and manliness to a large number of students without sacrifice of schoolroom work, they are worth keeping. On the whole he thinks the evidence is favorable, although it is quite possible also that games confined to the university grounds might prove equally beneficial. The unfortunate tendency which helps to degrade sports he considers the "spirit and method of trade," and for this he holds society in general responsible and looks to the university for the raising of ideals. In order to do this, the present definition of professionalism should be adhered to and modified only for very weighty reasons. In addition Mr. Hollis would favor a rule which would prevent ex-players from other colleges from playing intercollegiate games before they have been enrolled for one year, and would also extend this rule to all entering college, in order to overcome if possible the deplorable tendency to solicit promising athletic students in the preparatory schools. The appointment of a graduate treasurer, he believes, would prevent abuses in money matters. That these sports help to establish vigor generally among college men seems somewhat doubtful because of the very few whom the practices benefit; if they were the result of competition within the university and all students were encouraged to go out, this condition might be altered: that they do stimulate out-of-door activity among all the small boys of the land is not to be questioned. The bringing of the graduates and undergraduates together encourages college loyalty, even though much of it be but shouting loyalty, but the feeling of suspicion engendered between universities is often most unfortunate. As a means of teaching courage, football is, perhaps, overestimated; at any rate, moral courage is to be developed in many other ways and is apt to be distributed pretty evenly through the student body. Mr. Hollis firmly believes in the inherent love of fairness among students in general, and that this will eventually put an end to many of the abuses which attend intercollegiate sports.

M. G.

Paternalism in College Athletics (Walter R. Bridgeman, of Lake Forest College, in *Educational Review* for November).—The improvement which Mr. Bridgeman sees in college athletics he thinks due far more to improvement in college and public opinion and to the attacks of fearless critics than to Faculty control. "Paternalism" he believes not to be the panacea for present evils, but, as the permanent good of the student is the aim of college athletics, so these evils are to be cured only by the development of self-control and uniformity in the individual student. The three main objections to Faculty control he considers to be: loss of time, danger of loss of influence, and the dwarfing influence of official interference with a natural student activity. Mr. Bridgeman compares the spontaneous activity of college life and the healthy growth of sports at Yale and Princeton with other colleges where Faculty committees are particularly active. One place for the interference of the Faculty would be the limitation of intercollegiate sports to college departments, so that members of the professional schools should not be classed with undergraduates. Attention given to the amateur standing of men on their own teams rather than so much attention given to rival teams would also do much good. In the main, however, Mr. Bridgeman considers that the faculties of institutions could do far more good by giving their interest, counsel, and reproval perhaps, than by attempting to take the responsibility in athletic affairs.

M. G.

BOOK NOTICES AND BIBLIOGRAPHY.

PROPER FOOTWEAR AND THE TREATMENT OF WEAKENED AND FLAT FEET BY MECHANICAL DEVICES FOR MAINTAINING THE ADDUCTED POSITION, by John A. Sampson, M.D. *Johns Hopkins Hospital Bulletin,* January 7, 1902.

THE EFFECT OF FOOTWEAR ON THE FORM AND USEFULNESS OF THE FEET, by Phil. Hoffman, M.D. *St. Louis Courier of Medicine,* June, 1902.

SHOE DEFORMITIES, by E. H. Bradford, M.D. *New York Medical Journal,* October 18, 1902.

The appearance of three excellent papers on shoe deformities and disabilities by American surgeons within a year emphasizes the importance of the topic and the interest that is being taken in it by men at once scientific and practical. As the papers are written from slightly different points of view, their agreement on important points is all the more impressive. One may safely take their papers as an authoritative exposition of the conclusions of scientific experts on the subject. The main conclusion is that the average shoe is so faulty as regularly to produce certain typical deformities and disabilities of the foot; as a dealer quoted by Dr. Bradford says, "A shoe is sold almost entirely on style." The typical weakness results in abduction and eversion of the feet with toeing out, which is to be discouraged and corrected. Dr. Bradford emphasizes the fact that the size and shape of the working and resting foot are quite different, and shoes that are fairly or entirely comfortable with the foot at rest often become not only uncomfortable but injurious when unusual strain is put upon the foot, as in climbing, tramping, or gymnasium work. Shoes permitting the unusual spread of the foot under such conditions would not be marketable for ordinary wear. Therefore different patterns of shoes are necessary according to the use to which they are to be put. The last of commerce is a compromise when it is not a caricature. These considerations are of great practical importance in physical training. A special gymnasium shoe or slipper for exercising is a necessity; the one usually furnished, among numerous other faults, is almost invariably far too narrow across the ball of the foot. Dr. Bradford also points out that the more the natural spread and grasp of the foot is weakened by faulty footgear, the more the ankle is liable to injurious strains. The writer has elsewhere pointed out that the atrophied and degenerate foot of civilized life exercises a deteriorating effect on general posture.

These are all facts with which the physical trainer must reckon if his art is to render the service of which it is capable.

H. L. T.

LA GYMNASTIQUE FRANÇAISE. Eighteenth year. Nos. 9-10, September-October, 1902. 8 pages.

International congress of physical education; report by the secretary-general, M. Strehly. Gymnastics and the army, LeLot. An interesting sport, Pelote-Bosque hand-ball. Swimming championship, Maurice Boyan. Festivals and competitions.

H. L. T.

EDUCATION.

October. *The Physiology of Childhood as applied to Education,* by R. O. Beard, M.D.—A plea for the wider application of physiological laws in the education of children.

November. *A School Game for Girls,* by Stuart H. Rowe, Ph.D.—An enthusiastic account of the successful introduction of English Field Hockey into some of the grade and high schools of New Haven, Conn. Dr. Rowe believes this game is desirable for girls because he has found it holds their interest, and, while keeping them out of doors, it gives a comparatively large number (twenty-two) work which is pretty evenly distributed and affords opportunity for good team work. Field Hockey has been introduced into this country by Miss Applebee, an English woman who has taught it successfully to many college students. The rules are published in the Spalding Athletic Library.

EDUCATIONAL REVIEW.

November. *Is Color-Blindness Preventable?* by Alida S. Williams.—Miss Williams here gives statistics as to color-blindness in this and other countries, and gives the reasons for her conclusion that "color-blindness is the result of insufficient color-training in childhood, and that it is preventable if the instruction and guidance of the color sense begin in early youth".

Hygiene as a Factor in Education, by George A. Soper.—Mr. Soper refers to the difficulty that persons experience in this country if they wish to specialize in the subject of hygiene. He pleads for the better preparation of the grade teachers in order that they may give their pupils more intelligent care and training, for regular courses in college for those who wish to specialize, and for more efficient training of health officers.

PEDAGOGICAL SEMINARY.

September. *Christianity and Physical Culture,* by G. Stanley Hall.—An address delivered before the International Meeting of the Y. M. C. A., Boston, 1901.

ATLANTIC MONTHLY.

November. *Care of the Eyes,* by A. B. Norton.—An excellent paper on the care and use of the eyes, containing very helpful suggestions for parents, teachers, or others having the care of children.

OUTING.

September. *Women in Athletics; the Athletic Girl not Unfeminine,* by Christine Terhune Herrick.—Mrs. Herrick favors the introduction of athletics into girls' schools and colleges, not only for the physical benefit to be obtained but also as a means for strengthening the moral fibre of the girls, which, in the majority of cases, she seems to think is decidedly weak.

November. *How to Play Ping Pong,* by Arnold Parker. *Making a Football Team,* by William H. Lewis.

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DECEMBER, 1902.

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